Agriculture and Agri Food Canada Agriculture et Agroalimentaire Canada

2000 Pest Management Research Report (PMRR)
2000 Growing Season

2000 Rapport de recherches sur la lutte dirigée (RRLD)
pour le saison 2000

Compiled for
The Expert Committee on Integrated Pest Management (ECIPM)

Compilé par
le Comité d'experts sur la lutte intégrée (CELI)

February, 2001 / Février, 2001

Canada

English

2000 PEST MANAGEMENT RESEARCH REPORT

Compiled for: **THE EXPERT COMMITTEE ON INTEGRATED PEST MANAGEMENT (ECIPM)**

Chairperson: **Michel Letendre**

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The Official Title of the Report

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[1] This is the first time that the Report has been issued a volume number. It is based on the number of years that it has been published. See history on page iii.

This annual report is designed to encourage and facilitate the rapid dissemination of pest management research results, particularly of field trials, amongst researchers, the pest management industry, university and government agencies, and others concerned with the development, registration and use of effective pest management strategies. The use of alternative and integrated pest management products is seen by the ECIPM as an integral part in the formulation of sound pest management strategies. If in doubt about the registration status of a particular product, consult the Pest Management Regulatory Agency, Health Canada at 1-800-267-6315.

This year there were 134 reports. The Expert Committee on Integrated Pest Management is indebted to the researchers from provincial and federal departments, universities, and industry who submitted reports, for without their involvement there would be no report. Special thanks is also extended to the section editors for reviewing the scientific content and merit of each report, and to Stephanie Hilton for editorial and computer compilation services.
Suggestions for improving this publication are always welcome.

The 2000 Pest Management Research Report Table of Contents

- INTRODUCTION
- INDEXES

  Indexes consist of Authors*, Crop/Host, Pests (Insects/Mites; Diseases), Pest Management and Biological Control Methods, Products, Establishments, Editors.
- ENTOMOLOGY
- PLANT PATHOLOGY
- NEMATODES
- RESIDUES

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Procedures for the 2001 Annual PMR Report will be sent in September, 2001. They will also be published on our web site, or contact Stephanie Hilton.

Pest Management Research Report History.

1961 - The National Committee on Pesticide Use in Agriculture (NCPUA) was formed by its parent body, the National Coordinating Committee of Agricultural Services. It had three main duties: to define problems in crop and animal protection and to coordinate and stimulate research on pesticides; to establish principles for drafting local recommendations for pesticide use; and to summarize and make available current information on pesticides.

1962 - The first meeting of the NCPUA was held, and recommended the Committee should provide an annual compilation of summaries of research reports and pertinent data on crop and animal protection involving pesticides. The first volume of the Pesticide Research Report was published in 1962.

1970 - The NCPUA became the Canada Committee on Pesticide Use in Agriculture (CCPUA).

1978 - Name was changed to the Expert Committee of Pesticide Use in Canada (ECPUA).

1990 - The scope of the Report was changed to include pest management methods and therefore the name of the document was changed to the Pest Management Research Report (PMRR). The committee name was the Expert Committee on Pest Management (1990-1993) and the Expert Committee on Integrated Pest Management since 1994.

The publication of the Report for the growing season 2000 has been assigned a Volume number for the first time. Although there was a name change since it was first published, the purpose and format of the publication remains the same. Therefore based on the first year of publication of this document, the Volume Number will be Volume 39.

An individual report will be cited as follows:
Author(s). 2001. Title. 2000 Pest Management Research Report - 2000 Growing Season. Expert Committee on Integrated Pest Management. February, 2001. Report No. x. 39: pp-pp.

Français

Rapport de recherches sur la lutte dirigée - 2000

Préparé pour:	**LE COMITÉ D'EXPERTS SUR LA LUTTE INTÉGRÉE**
Président:	**Michel Letendre**
Préparé par:	**Agriculture et agroalimentaire Canada** **Centre des recherches du Sud sur la phytoprotectin et les aliments** **London, (Ontario) CANADA N5V 4T3**

Titre officiel du document
2000 Rapport de recherches sur la lutte dirigée - pour le saison 2000. Compilé par le Comité d'experts sur la lutte intégrée, par Agriculture et Agroalimentaire Canada, London (Ontario) Canada N5V 4T3. Février, 2001. 339p.
Publié sur disquette et l'Internet à http://res2.agr.ca/london/pmrc/english/report.html

La compilation du rapport annuel vise à faciliter la diffusion des résultats de la recherche dans le domaine de la lutte anti-parasitaire, en particulier, les études sur la terrain, parmi les chercheurs, l'industrie, les universités, les organismes gouvernementaux et tous ceux qui s'intéressent à la mise au point, à l'homologation et à l'emploi de stratégies antiparasitaires efficaces. L'utilisation de produits de lutte intégrée ou de solutions de rechange est perçue par Le Comité d'experts sur la lutte intégrée (CELI) comme faisant parti intégrante d'une stratégie judicieuse en lutte antiparasitaire. En cas de doute au sujet du statut d'enregistrement d'un produit donné, veuillez consulter Health Canada, Agence de Réglementation de la lutte anti-parasitaire à 1-800-267-6315.

Cette année, nous avons donc reçu 134 rapports. Les membres du Comité d'experts sur la lutte intégrée tiennent à remercier chaleureusement les chercheurs des ministères provinciaux et fédéraux, des universités et du secteur privé sans oublier les rédacteurs, qui ont fait la révision scientifique de chacun des rapports et en ont assuré la qualité, et Stephanie Hilton qui ont fourni les services d'édition et de compilation sur ordinateur. Vos suggestions en vue de l'amélioration de cette publication sont toujours très appréciées.

Le Rapport de recherches sur la lutte dirigée - La Table Des Matières

- L'AVANT-PROPOS
- LES INDICES
  Les sept indices liste pour le Rapport de recherche: Auteurs*, Hôtes (cultures), Ravageurs (des insectes; des maladies des plantes), Méthodes de lutte biologique, Produits (chimiques), Établissements, et les réviseurs.
- L'ENTOMOLOGIE
- LES MALADIES des PLANTES
- LES NÉMATODES
- LES RÉSIDUS

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Historique du *Rapport de recherche sur la lutte antiparasitaire*

Le Comité national sur l'emploi des antiparasitaires en agriculture (CNEAA) a été formé en 1961 par le Comité national de coordination des services agricoles. Il s'acquittait d'un triple mandat : cerner les problèmes touchant la protection des cultures et des animaux et coordonner et stimuler la recherche sur les pesticides; établir des principes pour l'élaboration de recommandations de portée locale sur l'utilisation des pesticides; synthétiser et diffuser l'information courante sur les pesticides.

À la première réunion du CNEAA, en 1962, il a été recommandé que celui-ci produise un recueil annuel des sommaires des rapports de recherche et des données pertinentes sur la protection des cultures et des animaux impliquant l'emploi de pesticides. C'est à la suite de cette recommandation qu'a été publié, la même année, le premier volume du *Rapport de recherche sur les pesticides*.

En 1970, le CNEAA est devenu le Comité canadien de l'emploi des pesticides en agriculture. Huit ans plus tard, on lui a donné le nom de Comité d'experts de l'emploi des pesticides en agriculture. En 1990, on a ajouté les méthodes de lutte antiparasitaire aux sujets traités dans le rapport, qui est devenu le *Rapport de recherche sur la lutte antiparasitaire*. Par la suite, le nom du comité a changé deux fois : Comité d'experts de la lutte antiparasitaire de 1990 à 1993 puis, en 1994, Comité d'experts de la lutte antiparasitaire intégrée.

L'an dernier, on a commencé à attribuer un numéro de volume au rapport annuel. Même si ce dernier a changé de titre depuis sa création, sa vocation et son format demeurent les mêmes. Ainsi, si l'on se reporte à la première année de publication, le rapport portant sur la saison de croissance de 2000 correspond au volume 39.

Modèle de référence :
[Nom de l'auteur ou des auteurs. Année de parution 2001. Titre (*2000 Rapport de recherche sur la lutte antiparasitaire*). Comité d'experts de la lutte antiparasitaire intégrée. Fev. 2001. Rapport n° x. 39:pp-pp.]

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TITLE: 2000 PEST MANAGEMENT RESEARCH REPORT - VOLUME 39

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SECTION A: TREE FRUIT AND BERRY CROPS /ARBRES FRUITIERES ET PETITS FRUITS

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2000 PMR REPORT # 1 **SECTION A: INSECT/MITE PESTS OF FRUIT STUDY DATA BASE:**

CROP:	Apple, cv. Red Delicious
PESTS:	European red mite (ERM), *Panonychus ulmi* (Koch) Two spotted spider mite (TSSM) *Tetranychus urticae* (Koch).
PREDATOR:	*Typhlodromus pyri* Scheuten (Acari: Phytoseiidae)

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TITLE: COMPATIBILITY OF A NOVEL MITICIDE WITH SUPPRESSION OF EUROPEAN RED MITE AND TWO-SPOTTED SPIDER MITE BY *TYPHLODROMUS PYRI* ON APPLE, 1999

MATERIALS: CARZOL 92 SP (formetanate), KELTHANE 35 WP (dicofol), PYRAMITE 75 WP (pyridaben), BIFENAZATE 50 WP

METHODS: The trial was conducted in an experimental apple orchard located in Sheffield Mills, Nova Scotia on a mature block of cv. "Red Delicious" apple trees, which had been coppiced 2 years previously to a height of 1.5 m. Each of the five miticide treatments were applied by truck-mounted sprayer on 20 August, 1999. Plots consisted of groups of five treated trees with at least one guard tree between plots. The control also included 5 single-tree plots. Pesticides were diluted to a rate comparable to 3000 litres/ha. Samples of 20 leaves per single-tree plot were taken on the dates shown below and passed through a mite-brushing machine. The count of 16 August, 1999 was taken four days before treatments were applied.

Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the plate.

RESULTS: Data are shown in Table 1. No phytotoxic effects were seen in the BIFENAZATE plots.

CONCLUSIONS: Pretreatment counts 16 August indicated no significant variations among the different plots before miticide treatments. Throughout the trial period, no significant differences were seen between any of the treatments for either the ERM or TSSM. However, seven days after treatment, *T. pyri* numbers were significantly lower in the CARZOL treatment than for either the control or other treatments. By eleven days after treatment, this difference was no longer noticable. However, by day 19, only the low and high rates of BIFENAZATE showed no significant difference in *T. pyri* numbers from the control, while all other treatments showed significantly fewer predatory mites.

Table 1. Densities of eggs (TPE) and active stages of *Typhlodromus pyri* (TP), of eggs (ERME) and active stages (ERM) of European red mite, of eggs (TSSME) and active stages (TSSM) of two spotted spider mite, and of active stages of apple rust mite (ARM). For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

	Rate				Densities			
Trmt	g[ai]/ha	TPE	TP	ERME	ERM	TSSME	TSSM	ARM
				16 Aug.	4 days	before	treatment	
Control		0.00a	0.92a	4.88a	1.33a	0.00a	0.00a	6.88a
CARZOL	1012	0.35a	1.48a	7.91a	1.40a	0.00a	0.00a	1.20b
BIFENAZATE	280	0.06a	1.08a	35.20a	4.00a	0.00a	0.40a	1.60ab
BIFENAZATE	420	0.17a	0.67a	13.80a	0.80a	0.00a	0.00a	2.40ab
KELTHANE	1575	0.17a	0.98a	7.20a	2.40a	0.20a	0.40a	0.00b
PYRAMITE	225	0.23a	0.94a	18.61a	0.60a	0.00a	0.20a	1.00b
				27 Aug.	Day 7			
Control		0.24ab	1.23a	2.41a	1.64a	0.23a	0.16a	1.19a
CARZOL	1012	0.00c	0.17b	0.72a	1.04a	0.08a	0.16a	0.24b
BIFENAZATE	280	0.39a	0.69ab	1.66a	2.60a	0.16a	0.23a	0.40ab
BIFENAZATE	420	0.12bc	1.00ab	0.56a	0.48a	0.00a	0.00a	0.00b
KELTHANE	1575	0.07bc	0.52ab	1.12a	1.44a	0.08a	0.00a	0.08b
PYRAMITE	225	0.00c	0.73ab	2.69a	0.97a	0.08a	0.00a	0.00b
				31 Aug.	Day 11			
Control		0.05a	0.61a	3.44a	0.56a	1.12a	0.08a	1.28a
CARZOL	1012	0.00a	0.12a	0.87a	0.55a	0.08b	0.08a	0.31a
BIFENAZATE	280	0.14a	0.86a	0.49a	0.98a	0.00b	0.00a	0.08a
BIFENAZATE	420	0.00a	0.75a	0.00a	0.08a	0.08b	0.00a	0.08a
KELTHANE	1575	0.00a	0.10a	2.08a	0.88a	0.00b	0.00a	0.16a
PYRAMITE	225	0.00a	0.12a	0.88a	0.16a	0.08b	0.00a	0.00a
				8 Sept.	Day 19			
Control		0.07a	0.79a	0.16a	0.08a	0.00a	0.08a	0.16a
CARZOL	1012	0.00a	0.04b	0.07a	0.15a	0.08a	0.16a	0.00b
BIFENAZATE	280	0.02a	0.80a	0.08a	0.00a	0.00a	0.00a	0.00b
BIFENAZATE	420	0.00a	0.67a	0.00a	0.00a	0.00a	0.00a	0.00b
KELTHANE	1575	0.00a	0.00b	0.56a	0.40a	0.00a	0.08a	0.00b
PYRAMITE	225	0.00a	0.10b	0.00a	0.00a	0.00a	0.00a	0.00b

2000 PMR REPORT # 2 **SECTION A: INSECT/MITE PESTS OF FRUIT STUDY DATA BASE:**

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch)
Two spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
Apple rust mite (ARM) *Aculus schlechtendali* (Nalepa)

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TITLE: EFFICACY OF A NOVEL MITICIDE AGAINST THE TWO SPOTTED SPIDER MITE AND EUROPEAN RED MITE ON APPLE, 1999

MATERIALS: CARZOL 92 SP (formetanate), KELTHANE 35 WP (dicofol), PYRAMITE 75 WP (pyridaben), BIFENAZATE 50 WP

METHODS: The trial was conducted in a 2.06 ha, 12 yr-old commercial apple orchard located near Kingston, Nova Scotia. Trees were planted at a spacing of 3.7 X 5.5 m. Each of the five miticide treatments were applied by truck-mounted sprayer on 28 July, 1999. Each treatment was applied to six single-tree plots, three at the eastern end and three at the western end of the orchard. Pesticides were diluted to a rate comparable to 3000 litres/ha. Samples of 20 leaves per tree were taken on the dates shown below and passed through a mite-brushing machine. The precount of 28 July, 1999 was taken just 1 h before treatments were applied. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the plate.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: Pretreatment counts 28 July indicated damaging numbers of two-spotted spider mites, TSSM, (22- 43 motiles per leaf) and European red mites (4- 11 motiles per leaf) with relatively low, non-damaging numbers of apple rust mite, which have an economic threshold of > 200 mites per leaf. ARM counts varied erratically but did sometimes show significant treatment effects by CARZOL, KELTHANE or PYRAMITE. There were no significant variations for ERM and TSSM among the different plots before miticide treatments. For counts made 6 and 15 days after treatment, the control was found to be significantly higher than the treated plots for both ERM and TSSM. By 20 days after treatment, the control continued to be significantly higher than the treated plots for both ERM and TSSM. ERM numbers were shown to be the lowest in the PYRAMITE plots with 0 mites per leaf while there was no significant difference between the treatments for TSSM numbers. Thirty-three days after treatment, ERM counts in the PYRAMITE plot were still significantly lower than both the control and other treatments, however TSSM numbers did not vary greatly between the treatments by this point. Overall, CARZOL maintained the lowest TSSM numbers throughout the trial period, while PYRAMITE proved most effective in controlling ERM. BIFENAZATE did not appear to be toxic to apple rust mite, which is an important supplementary food source for predatory phytoseiid mites such as *Typhlodromus pyri*, *Amblyseius fallacis* or *Metaseiulus occidentalis* when ERM and TSSM are scarce.

Table 1. Densities of eggs (ERME) and active stages (ERM) of European red mite, of eggs (TSSME) and active stages (TSSM) of two spotted spider mite and apple rust mite (ARM). For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

Treatment	Rate g [a.i.] /ha	ERME	ERM	Densities TSSME	TSSM	ARM
			28 July	Pre-treatment		
Control		51.65a	4.68a	69.70a	22.26a	8.24a
CARZOL	1012	67.45a	7.49a	100.83a	36.14a	0.00b
BIFENAZATE	280	74.59a	10.72a	81.11a	43.11a	2.67ab
BIFENAZATE	420	45.78a	4.22a	108.56a	37.78a	2.22ab
KELTHANE	1575	60.62a	4.49a	143.32a	38.61a	3.16ab
PYRAMITE	225	44.00a	6.00a	87.67a	24.00a	0.67ab
			3 Aug.	6 Days		
Control		32.67a	19.00a	81.00a	56.33a	8.50a
CARZOL	1012	17.37ab	3.30bcd	24.07a	5.21d	0.70b
BIFENAZATE	280	8.45b	5.33bc	34.02bc	15.59cd	4.41ab
BIFENAZATE	420	10.83b	5.67b	79.00a	43.00ab	3.83ab
KELTHANE	1575	9.76b	1.86cd	35.54bc	22.37bc	1.67b
PYRAMITE	225	8.50b	1.33d	59.17ab	30.67bc	2.17b
			12 Aug.	15 Days		
Control		24.30a	11.99a	41.54a	64.47a	5.00a
CARZOL	1012	6.72b	4.68b	2.51d	1.84d	2.83a
BIFENAZATE	280	7.38b	3.35bc	10.80cd	18.37bc	1.17a
BIFENAZATE	420	16.35a	4.74b	37.46ab	26.75b	7.17a
KELTHANE	1575	6.71b	2.52bc	15.45bc	8.82c	3.22a
PYRAMITE	225	2.36b	1.00c	34.55ab	28.26b	1.73a
			17 Aug.	20 Days		
Control		10.00ab	6.67a	17.50ab	17.50a	1.17a
CARZOL	1012	16.47a	3.02b	5.90c	6.08bc	0.17a
BIFENAZATE	280	6.18ab	1.01c	8.12bc	5.37c	1.84a
BIFENAZATE	420	6.50ab	3.33b	33.67a	16.83ab	4.50a
KELTHANE	1575	7.00ab	1.33c	9.17bc	5.67c	0.50a
PYRAMITE	225	4.33b	0.00d	26.00a	13.00abc	0.50a
			30 Aug	33 Days		
Control		4.34a	2.00ab	4.46b	7.52ab	10.87a
CARZOL	1012	3.35ab	3.54a	7.49ab	2.89b	1.00b
BIFENAZATE	280	1.50cd	1.00b	3.67b	4.17ab	4.50ab
BIFENAZATE	420	2.67bc	3.17a	6.17ab	9.33a	10.67a
KELTHANE	1575	3.67ab	2.67ab	5.17b	3.50ab	0.33b
PYRAMITE	225	0.67d	0.33b	14.49a	6.00ab	0.48b

2000 PMR REPORT # 3 **SECTION A: INSECT/MITE PESTS OF FRUIT STUDY DATA BASE:**

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch)
Two-spotted spider mite (TSSM) *Tetranychus urticae* (Koch).
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFICACY OF A SELECTIVE MITICIDE AGAINST TWO SPOTTED SPIDER MITES AND EUROPEAN RED MITES ON APPLE, 2000

MATERIALS: CARZOL 92 SP (formetanate), KELTHANE 35 WP (dicofol), BIFENAZATE 50 WP

METHODS: The trial was conducted in a 2.06 ha, 13 yr-old commercial apple orchard located near Kingston, Nova Scotia. Trees were planted at a spacing of 3.7 X 5.5 m. Each treatment and the control comprised 6 single tree plots located in the eastern three rows (numbers 16, 17 and 18) of the 18-row orchard. Pesticides were diluted to a rate comparable to 3000 litres/ha. and were applied to runoff by a truck-mounted sprayer set at 2200 kPa pressure through a 2.5 mm orifice nozzle. Control trees were sprayed with the same volume of water. Samples of 20 leaves per tree, totalling 120 leaves per treatment, were taken on 31 July 2000 and the dates shown in Table 2. Leaves were passed through a mite-brushing machine. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the glass collecting plate. The precount of 31 July was taken 2 days before treatments were applied on 2 August 2000. Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Five trees in each of rows 5,6 and 7 were each inoculated with at least 20 pyrethroid/organophosphate resistant *T. pyri* (the New Zealand strain) on 21 July 2000. To monitor immigration of two-spotted spider mites into trees we placed masking tape covered with Tangletrap on 6 trees in the orchard. Bands were removed and replaced and mites on bands were counted in the lab every 2 weeks from 3 August to 29 August.

RESULTS: Data for the precount are shown in Table 1. Least squares means adjusted for the precount are shown in Table 2.

CONCLUSIONS: The economic thresholds for two-spotted spider mites and European red mite are a combined total (both species) of 5 motile stages per leaf. Pretreatment counts taken 31 July indicated combined totals were near or slightly above the economic threshold and that mean densities for the different treatments varied significantly (Table 1). For this reason we used analysis of covariance to examine all post treatment data from 8 August to 5 September. Table 2 shows least squares means which have been adjusted to compensate for differences in pretreatment densities. Densities of motile ERM stayed relatively low throughout the trial with a maximum count of ca. 3 per leaf occurring in the control on 22 August. It is likely that severe competition from TSSM helped suppress ERM in all plots including the control. Within 6 days after treatment, counts of motile TSSM were less than the control in the CARZOL plots. By 14 August, 12 days after spray, there were also significant reductions in the KELTHANE plots and those treated with the lower rate of BIFENAZATE. Thereafter all treated plots had significantly fewer motile TSSM than the water treated control until the trial ended 5 September, 34 days after treatment. Counts of the predator mite *T. pyri* were < 0.1 per leaf and occurrences were sporadic until 5 September when mean densities ranged from 0 in the KELTHANE plots to 0.04 per leaf in the CARZOL plots to 0.31 in the control, and densities were 0.34 and 0.39 in the plots treated with the lower and the higher rates of BIFENAZATE, respectively. Populations of *T. pyri*, however, were too low through most of the trial to suppress TSSM. Mean counts of mites on sticky bands were 3602 and 542 for the intervals from 3-16 August and 17-29 August respectively, indicating over 4000 TSSM climbed up each tree in the month of August. Thus miticides applied to the trees not only had to control all mites on the foliage but also several thousand immigrants.

Table 1. Mean densities per leaf of eggs (ERME) and active stages (ERM) of European red mite, and of eggs (TSSME) and active stages (TSSM) of two spotted spider mite. For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P = 0.05$).

Treatment	Rate g [a.i.]/ha	ERME	ERM	TSSME	TSSM
		31 July		Pretreatment	
Control		3.29 b	0.50 b	7.48 a	2.54 c
KELTHANE	1575	1.62 b	1.39 b	5.56 a	6.41 ab
CARZOL	1012	13.60 a	7.96 a	3.65 a	2.48 bc
BIFENAZATE	280	4.17 b	1.33 b	9.33 a	4.33 bc
BIFENAZATE	420	18.65 a	6.64 a	12.67 a	11.14 a

Table 2. Least squares means for densities per leaf of eggs (ERME) and active stages (ERM) of European red mite, and of eggs (TSSME) and active stages (TSSM) of two spotted spider mite. For a given column and a given date, means followed by the same letter are not significantly different (P = 0.05).

	Rate	Least squares means for densities per leaf at indicated date and DAT			
Treatment	g [a.i.]/ha	ERME	ERM	TSSME	TSSM
			8 Aug.	6 days	
Control		8.17a	0.69a	12.39a	5.03a
KELTHANE	1575	2.57b	0.17a	10.38a	1.97a
CARZOL	1012	11.41a	0.47a	1.69b	0.93b
Bifenazate	280	0.91b	0.39a	11.49a	5.90a
Bifenazate	420	11.50a	1.77a	11.22a	3.98a
			14 Aug.	12 days	
Control		10.41a	2.80a	26.95a	11.30a
KELTHANE	1575	4.17bc	1.18a	9.17b	2.18c
CARZOL	1012	5.90ab	1.75a	1.71c	2.31b
Bifenazate	280	2.63b	0.53a	10.33b	6.04b
Bifenazate	420	0.00bc	0.80a	12.84b	7.13ab
			22 Aug.	20 days	
Control		1.48a	2.20a	28.41a	22.93a
KELTHANE	1575	0.31bc	0.00b	6.24c	1.54d
CARZOL	1012	2.25ab	3.27a	3.48c	2.58cd
Bifenazate	280	0.54ab	0.00b	10.33b	6.17c
Bifenazate	420	0.37ab	3.20a	9.67b	13.34b
			28 Aug.	26 days	
Control		4.81a	2.24a	24.08a	24.43a
KELTHANE	1575	3.19a	0.98a	9.91b	3.23c
CARZOL	1012	6.60a	1.20a	6.41c	2.89c
Bifenazate	280	2.88a	1.08a	18.81ab	10.64bc
Bifenazate	420	4.03a	0.11a	7.96c	6.77b
			5 Sept.	34 days	
Control		4.53ab	2.31a	49.37a	57.40a
KELTHANE	1575	1.43c	0.80a	12.56b	3.29c
CARZOL	1012	8.08a	2.20a	12.60b	5.28bc
Bifenazate	280	0.26c	0.10b	8.97b	17.33b
Bifenazate	420	2.76bc	0.79a	13.50b	13.01bc

CROP: Apple, cv. Red Delicious
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch)
Two spotted spider mite (TSSM) *Tetranychus urticae* (Koch).
PREDATOR: *Typhlodromus pyri* Scheuten

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TITLE: COMPATIBILITY OF BIFENAZATE WITH BIOLOGICAL CONTROL OF EUROPEAN RED MITES BY TYPHLODROMUS PYRI, 2000

MATERIALS: KELTHANE 35 WP (dicofol), PYRAMITE 75 WP (pyridaben), Bifenazate 50 WP

METHODS: The trial was conducted in a 0.6 ha orchard block located in Sheffield Mills, Nova Scotia on 38 yr old cv. "Red Delicious" apple trees planted at a spacing of 4.6 x 7.9 m, which had been coppiced 3 years previously to a height of 1.5 m. By the time of this trial, the trees were covered with a dense growth of water sprouts and tops of some shoots reached a height of 3.5 m. Each of the four miticide treatments and a water-sprayed control were applied by truck-mounted sprayer set at 2000 kPa pressure through a 2.5 mm orifice nozzle on 28 July 2000. There were 4 single-tree plots per treatment plus 5 control trees. There were also guard trees between trees given different treatments. Pesticides were diluted to a rate comparable to 3000 litres/ha. Samples of 20 leaves per single-tree plot were taken on the dates shown below and passed through a mite-brushing machine. The count of 28 July was taken just before treatments were applied. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the plate.

RESULTS: Data are shown in Table 1. No phytotoxic effects were seen in the bifenazate plots.

CONCLUSIONS: Pretreatment counts 28 July indicated no significant variations in treatment means. Throughout the trial period, mean densities of ERM were low, often zeros, with values always < 4 active mites per leaf and seldom > 1 per leaf, indicating effective suppression by *T. pyri*. With the predator, *T. pyri*, the only significant treatment effects were observed 22 August, 25 days after application, when mean densities of motile stages (larvae, nymphs and adults) in one of the bifenazate treatments was as high as the control but the means for KELTHANE was zero and means for PYRAMITE and the other bifenazate treatment were significantly lower than the control. Because trees were widely spaced within rows (foliage of adjacent trees separated by ~4 metres) and because *T. pyri* is known to be a slow disperser, we conclude that predator recovery after treatment was likely due to population growth of survivors on the treated trees rather than immigration from untreated trees. These data clearly indicate that use of bifenazate is compatible with control of spider mites by *T. pyri.* Note that *T. pyri* was able to persist on the trees despite the virtual absence of tetranychid mites because this predator can feed on wind-borne pollen found on apple leaves.

Table 1. Densities of eggs (ERME) and active stages (ERM) of European red mite, and eggs (TPE) and active stages of *Typhlodromus pyri* (TP). For *T. pyri* on 22 August, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$). In all other cases treatment means did not differ significantly from the control.

Treatment	Rate g [a.i.]/ha	ERME	ERM	TPE	ERME	ERM	TPE	TP
		July 28		0 days	8 Aug.		11 days	
Control		0.2	0	0.29	1.8	0.2	0	0.21
KELTHANE	1575	0.25	0	0.15	0	0	0	0
PYRAMITE	225	0	0	0.58	0.5	0	0.22	0.2
Bifenazate	280	0.75	0	0.37	0.48	0	0.07	0.32
Bifenazate	420	0	0	0.29	0	0	0.29	0.25
		14 Aug.		17 days	22 Aug.		25 days	
Control		1.60	0.80	0.17	0.80	0.60	0.52	0.93a
KELTHANE	1575	0.00	0.00	0.00	0.00	0.00	0.00	0.00b
PYRAMITE	225	0.00	0.00	0.22	0.00	0.00	0.07	0.13b
Bifenazate	280	0.23	0.00	0.07	0.00	0.00	0.00	0.26b
Bifenazate	420	0.00	0.00	0	0.00	0.00	0.07	0.58ab
		28 Aug.		31 days	7 Sept.		41 days	
Control		1.40	1.80	0.00	1.00	3.40	0.12	1.42
KELTHANE	1575	0.00	0.00	0.00	0.00	0.00	0.00	0.38
PYRAMITE	225	0.00	0.00	0.07	0.00	0.00	0.22	1.13
Bifenazate	280	0.00	0.00	0.00	0.00	0.00	0.14	0.64
Bifenazate	420	0.00	0.00	0.07	0.00	0.00	0.07	0.58

2000 PMR REPORT # 5

SECTION A: INSECT/MITE PESTS OF FRUIT
STUDY DATA BASE:

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch)
Two spotted spider mite (TSSM) *Tetranychus urticae* (Koch).
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFICACY OF PYRAMITE AND PYRAMITE-FUNGICIDE MIXTURES AGAINST THE TWO SPOTTED SPIDER MITE ON APPLE, 2000

MATERIALS: PYRAMITE 75 WP (pyridaben), POLYRAM 80 DF (metiram), SOVRAN 50 WG (kresoxim-methyl)

METHODS: The trial was conducted in a 2.06 ha, 14 yr-old commercial apple orchard located near Kingston, Nova Scotia. Trees were planted at a spacing of 3.7 x 5.5 m. Each treatment and the control comprised 4 single tree plots arranged in a randomized complete block design. Two blocks were in the westernmost row (row 1) and two in row 3 of the orchard. Treated trees were separated from other treated trees by 1-3 unsprayed guard trees. Pesticides were diluted to a rate comparable to 3000 litres/ha. and were applied to runoff by a truck-mounted sprayer set at 2800 kPa pressure through a 2.5 mm orifice nozzle. About 18 L of solution was sprayed on each tree. Samples of 20 leaves per tree were taken on the dates shown below and passed through a mite-brushing machine. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the glass collecting plate. The precount was taken just before treatments were applied on 9 August 2000. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Five trees in each of rows 5, 6 and 7 were each inoculated with at least 20 pyrethroid/organophosphate resistant *T. pyri* (the New Zealand strain) on 21 July 2000.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: There were no significant differences in treatments means of European red mites or two-spotted spider mites on 8 August, 1 day before treatments were applied. Although treatment means for motile two-spotted spider mites (TSSM) were lower than the control 5 and 13 days after treatment, these differences were not significant at $P = 0.05$ because of large tree-to-tree variations in mite counts. By 28 August, 19 days after spray, trees sprayed with the middle or high rate of PYRAMITE had significantly fewer TSSM than the control. These contrasts persisted until 12 September, 34 days after treatment. By 5 September, 27 days after treatment, mean TSSM densities were less than the control for all treatments except the PYRAMITE/SOVRAN mixture. By 12 September *T. pyri* began to appear in all treatments but predator densities were too low (nearly always < 0.2 per leaf) to suppress TSSM and ERM. A major factor in this trial was mass migration of TSSM up tree trunks from weeds into the trees.

In August and September we observed captures of several thousand TSSM per tree per week on sticky bands affixed to tree trunks.

Table 1. Densities of eggs (ERME) and active stages (ERM) of European red mite, of eggs (TSSME) and active stages (TSSM) of two spotted spider mites. For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P = 0.05$).

Treatment	Rate g ai/ha	ERME	ERMA	TSSME	TSSM	ERME	ERM	TSSME	TSSM
			8	-1 day			14 August	5 days	
Control		9.75a	2.00a	15.25a	5.00a	7.50a	0.50a	29.25a	13.75a
PYRAMITE	56	3.19a	0.49a	11.44a	4.47a	2.75a	1.50a	15.00a	5.25a
PYRAMITE	112	2.44a	1.00a	13.43a	6.00a	1.97a	0.73a	8.76a	3.63a
PYRAMITE	225	14.50a	2.25a	13.75a	5.00a	5.25a	0.25a	9.00a	1.00a
PYRAMITE + POLYRAM	56 + 3600	14.36a	1.28a	23.74a	8.86a	8.37a	0.79a	25.49a	7.36a
PYRAMITE + POLYRAM	112+3600	8.50a	0.25a	16.00a	9.50a	6.86a	0.25a	28.17a	6.30a
PYRAMITE + POLYRAM	225+3600	13.88a	1.25a	23.17a	8.18a	6.00a	1.25a	20.75a	9.25a
PYRAMITE + SOVRAN	56+80	19.50a	0.75a	28.25a	14.50a	6.44a	0.24a	24.31a	7.98a
			August 22	13 days			August 28	19 days	
Control		2.54ab	3.04a	28.04a	13.04a	6.29a	2.76a	31.83a	21.9a
PYRAMITE	56.0	2.00ab	2.25a	16.50a	10.25a	0.75a	0.50a	22.25ab	10.25abc
PYRAMITE	112.0	1.25ab	0.50a	16.50a	5.50a	0.25a	0.00a	9.50b	1.50c
PYRAMITE	225	3.37ab	1.72a	12.72a	10.15a	1.28a	3.61a	9.39ab	4.00bc
PYRAMITE + POLYRAM	56+3600	4.48ab	1.75a	15.03a	7.36a	6.28a	0.25a	9.53ab	12.03ab
PYRAMITE + POLYRAM	112+3600	2.60ab	0.25a	11.87a	5.21a	1.25a	0.00a	9.25ab	9.00abc
PYRAMITE + POLYRAM	225+3600	5.98a	1.74a	15.20a	7.72a	4.50a	2.00a	10.47ab	6.23abc
PYRAMITE + SOVRAN	56+80	1.00b	2.00a	20.00a	14.75a	2.78a	0.79a	21.17ab	14.87ab
			5 Sept.	27 days			12 Sept.	34 days	
Control		2.28a	1.76a	25.87a	48.76a	2.00a	1.72a	23.26a	40.76a
PYRAMITE	56	2.00a	0.00a	24.25a	16.50bc	0.25a	0.25b	20.00a	15.75ab
PYRAMITE	112.0	0.25a	0.73a	18.42a	6.43c	0.25a	0.25b	18.50a	6.25b
PYRAMITE	225.0	1.33a	0.17a	15.83a	8.00c	0.50a	0.33b	28.50a	12.67b
PYRAMITE + POLYRAM	56+3600	1.00a	1.00a	22.75a	27.75ab	1.75a	0.00b	18.00a	14.25b
PYRAMITE + POLYRAM	112+3600	0.50a	2.00a	21.25a	10.50bc	0.50a	0.00b	16.25a	13.50b
PYRAMITE + POLYRAM	225+3600	0.50a	0.00a	16.75a	9.50bc	1.75a	0.25b	16.00a	13.75b
PYRAMITE +	56+80	0.75a	0.50a	25.00a	42.75a	0.00a	0.25b	20.75a	19.75ab

2000 PMR REPORT # 6 **SECTION A: INSECT/MITE PESTS OF FRUIT STUDY DATA BASE:**

CROP:	Apple, cv. Jonagold
PEST:	European red mite (ERM), *Panonychus ulmi* (Koch)
PREDATOR:	*Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFECT OF PYRAMITE-FUNGICIDE MIXTURES ON EUROPEAN RED MITE AND *TYPHLODROMUS PYRI* ON POTTED APPLE TREES

MATERIALS: PYRAMITE 75 WP (pyridaben), POLYRAM 80 DF (metiram), SOVRAN 50 WG (kresoxim-methyl)

METHODS: Treatments were applied 31 July 2000 to 3 yr old, 1.5-2.0 m tall potted Jonagold apple trees housed in a 31 x 6 m tunnel house covered by 60% shade cloth. On the day of treatment, five trees randomly assigned to each treatment were removed from the tunnel house and were sprayed to drip using a gasoline powered back pack sprayer with dilutions equivalent to 3000 L/ha. Trees were returned to the tunnel house and randomly placed in eight rows of five trees each with spacings of at least 80 cm so that there was no direct contact between foliage of adjacent trees. *Typhlodromus pyri* is not a particularly active disperser so it was felt that treatment effects would be accurately reflected in post spray counts of this predator. A precount of mites was made several hours before treatments and 7, 14, 21, 29 and 36 days after treatment. On each sampling date 5 leaves were removed from each tree and upper and lower leaf surfaces were directly examined for mites and their eggs under a microscope at 12x or more magnification.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: The precount of 31 July indicated mean densities of European red mites and motile stages of *T. pyri* did not vary among treatments but there was some variability among densities of *T. pyri* eggs. In the dates after treatment there seemed to be a negative correlation between concentration of PYRAMITE used in the treatment and the density of motile *T. pyri*: as concentration increased there was a corresponding decrease in post-spray densities of motile *T. pyri*. The presence of either fungicide, POLYRAM or SOVRAN, in the treatment did not seem to affect density of *T. pyri* until the final sampling date. Densities of active European red mites did show slight recovery by 5 September in trees treated with the 112 g rate of PYRAMITE and with trees treated POLYRAM and the two lower rates of PYRAMITE suggesting possible interference with red mite suppression by *T. pyri*. We conclude that PYRAMITE, alone or mixed with POLYRAM or SOVRAN, is compatible with *T. pyri* but the two lower rates of PYRAMITE would be preferable for conserving the predator.

Table 1. Densities of eggs (ERME) and active stages (ERM) of European red mite and eggs (TPE) and active stages (TP) of *T. pyri*. For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P = 0.05$).

Treatment	Rate g [a.i.] /ha	ERME	ERM	TPE	TP	ERME	ERM	TPE	TP
		31 July 0 days				7 Aug. 7 days			
Control		0.72a	0.40a	0.04b	0.92a	0.68ab	0.12a	0.04ab	0.76bc
PYRAMITE	56.0	0.64a	0.04a	0.00b	2.52a	0.04b	0.04a	0.00b	1.00ab
PYRAMITE	112.0	1.08a	0.04a	0.40a	2.32a	0.28ab	0.20a	0.00b	0.36c
PYRAMITE	225.0	0.28a	0.08a	0.04b	1.36a	0.40ab	0.20a	0.00b	0.32c
PYRAMITE	56.0	0.36a	0.00a	0.08b	2.20a	0.40ab	0.08a	0.08ab	1.64a
+ POLYRAM	3600.0								
PYRAMITE	112.0	1.12a	0.20a	0.16ab	1.44a	0.52ab	0.12a	0.04ab	0.72bc
+ POLYRAM	3600.0								
PYRAMITE	225.0	0.80a	0.12a	0.16ab	1.92a	0.52ab	0.20a	0.00b	0.36c
+ POLYRAM	3600.0								
PYRAMITE	56.0	0.92a	0.44a	0.00b	1.40a	1.24a	0.08a	0.12a	1.36ab
+ SOVRAN	80.0								

Table 1. Continued.

Treatment	Rate g [a.i.] /ha	ERME	ERM	TPE	TP	ERME	ERM	TPE	TP
		14 Aug. 14 days				21 Aug. 21 days			
Control		0.36a	0.56a	0.24a	1.04ab	0.80a	0.00a	0.05a	0.90ab
PYRAMITE	56.0	0.04a	0.20a	0.16a	0.88ab	0.36a	0.00a	0.04a	0.76ab
PYRAMITE	112.0	3.44a	0.28a	0.28a	0.24b	1.56a	0.32a	0.00a	0.40bc
PYRAMITE	225.0	2.20a	0.48a	0.00a	0.28ab	2.92a	0.32a	0.00a	0.00c
PYRAMITE	56.0	4.60a	1.60a	0.16a	0.80ab	5.12a	0.72a	0.08a	1.36a
+ POLYRAM	3600.0								
PYRAMITE	112.0	2.44a	0.28a	0.04a	0.40ab	4.68a	0.56a	0.00a	0.68ab
+ POLYRAM	3600.0								
PYRAMITE	225.0	2.00a	0.48a	0.00a	0.16b	3.21a	0.48a	0.00a	0.04c
+ POLYRAM	3600.0								
PYRAMITE	56.0	0.76a	0.12a	0.40a	1.12a	0.28a	0.00a	0.00a	0.88ab
+ SOVRAN	80.0								
		29 Aug. 29 days				5 Sept. 36 days			
Control		0.72a	0.00b	0.04ab	0.80abc	0.52b	0.00b	0.12ab	1.32ab
PYRAMITE	56.0	0.56a	0.12ab	0.00b	0.84ab	0.56b	0.00b	0.08ab	1.04ab
PYRAMITE	112.0	2.32a	0.12ab	0.04ab	0.20bc	1.44ab	0.68ab	0.04ab	0.52bc
PYRAMITE	225.0	4.68a	0.72ab	0.00b	0.00c	1.60ab	0.44ab	0.00b	0.20c
PYRAMITE	56.0	21.24a	1.92a	0.16ab	1.56a	11.64a	2.16a	0.32a	2.12a
+ POLYRAM	3600.0								
PYRAMITE	112.0	14.04a	0.20ab	0.00b	0.52abc	7.56ab	1.72ab	0.00b	0.20c
+ POLYRAM	3600.0								
PYRAMITE	225.0	10.64a	1.20ab	0.00b	0.36abc	0.56ab	0.32ab	0.04ab	0.16c
+ POLYRAM	3600.0								
PYRAMITE	56.0	2.64a	0.20ab	0.20a	0.92ab	4.12ab	0.08b	0.00b	1.16ab
+ SOVRAN	80.0								

2000 PMR REPORT # 7 **SECTION A: INSECT/MITE PESTS OF FRUIT STUDY DATA BASE:**

CROP:	Apple, cv. McIntosh (MacSpurr)
PESTS:	European red mite (ERM), *Panonychus ulmi* (Koch) Two spotted spider mite (TSSM) *Tetranychus urticae* (Koch).
PREDATOR:	*Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFECTS OF PYRAMITE AND PYRAMITE-FUNGICIDE MIXTURES ON TWO SPOTTED SPIDER MITE AND *TYPHLODROMUS PYRI* ON APPLE, 1999

MATERIALS: PYRAMITE 75 WP (pyridaben) and POLYRAM 80 DF (metiram).

METHODS: The trial was conducted in a commercial apple orchard located in Upper Canard, Nova Scotia. on three year old MacSpurr trees on M9 rootstock. Each of the six miticide-fungicide mixtures was applied by truck-mounted sprayer on 5 July 1999 to seven-tree plots with four plots per treatment arranged in a randomized complete block design. Four plots of trees served as untreated controls. Pesticides were diluted to a rate comparable to 3000 litres/ha. Samples of three leaves from each of the five interior trees per plot were taken on the dates shown below and passed through a mite-brushing machine. The count of 5 July, 1999 was taken just before the treatments were applied. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 7.5 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the T. pyri actually found on leaves. Counts for *P. ulmi* and *T. urticae* were from 1/16th of the plate. This orchard had been inoculated with several thousand pyrethroid/organophosphate resistant T. pyri (the New Zealand strain) in the summer of 1997.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: Pretreatment counts of 5 July indicated potentially damaging numbers of two-spotted spider mites, TSSM, (3-22 motiles per leaf) and relatively high numbers of *T. pyri* (1.4-2.4 per leaf, Table 1). There were no significant variations among the different plots before miticide treatments. For counts made 3 and 9 days after treatments, there was still no difference between the control and the treated plots. By 15 days post treatment counts of TSSM, ERM and *T. pyri* in all treated plots were significantly lower than counts in the control. By 21 days after treatment, counts of motile stages of TSSM and ERM in treated plots did not differ from the control, whereas counts of *T. pyri* in most treated plots were significantly lower than those in the control. By 31 and 38 days after treatment, there was no longer any significant difference between mite levels in any of the treatments for both predators and prey. The lower and intermediate rates of PYRAMITE, applied either alone or mixed with POLYRAM seemed to cause less suppression of predatory mite *T. pyri* than did the high rate of PYRAMITE. Hence it may be advisable to use the lower or intermediate rates of PYRAMITE where predator-prey ratios indicate a good prospect for integrating miticide use with biological control.

Table 1. Densities of eggs (ERME) and active stages (ERM) of European red mite, of eggs (TSSME) and active stages (TSSM) of two spotted spider mite and eggs (TPE) and active stages (TP) of *T. pyri*. For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

Treatment	Rate g [a.i.]/ha	ERME	ERM	TSSME	TSSM	TPE	TP
				5 July	Pre-Treatment		
Control		3.00a	0.00a	21.33a	11.34a	0.68a	1.38a
PYRAMITE	56	2.22a	0.00a	6.67a	6.22a	0.90a	2.29a
PYRAMITE	112.0	0.00a	0.00a	3.11a	3.11a	0.39a	2.40a
PYRAMITE	225.0	3.00a	1.33a	25.00a	21.67a	.78a	1.80a
PYRAMITE	56.0	1.67a	1.00a	7.67a	6.00a	0.58a	1.89a
+ POLYRAM	3600.0						
PYRAMITE	112.0	0.00a	0.33a	11.34a	6.34a	0.10a	1.55a
+ POLYRAM	3600.0						
PYRAMITE	225.0	2.00a	1.00a	24.67a	19.67a	0.49a	1.72a
+ POLYRAM	3600.0						
				8 July	3 Days		
Control		1.67a	1.34a	7.00a	1..67a	0.97a	1.89a
PYRAMITE	56.0	0.67a	0.67a	7.67a	2.33a	0.87a	1.03a
PYRAMITE	112.0	0.33a	0.33a	2.67a	0.00a	0.39a	0.86a
PYRAMITE	225.0	1.00a	0.33a	3.67a	0.33a	0.58a	0.77a
PYRAMITE	56.0	0.33a	0.33a	2.00a	0.33a	0.29a	1.03a
+ POLYRAM	3600.0						
PYRAMITE	112.0	1.00a	0.67a	10.00a	3.33a	0.58a	0.52a
+ POLYRAM	3600.0						
PYRAMITE	225.0	2.33a	0.00a	34.33a	0.67a	0.00a	0.60a
+ POLYRAM	3600						
				14 July	9 Days		
Control		0.00a	1.00a	1.00a	1.67a	0.22a	0.69a
PYRAMITE	56.0	0.33a	0.00a	0.00a	0.67a	0.29a	0.43a
PYRAMITE	112.0	0.33a	0.00a	0.00a	0.33a	0.00a	0.17a
PYRAMITE	225.0	0.33a	0.00a	1.33a	0.33a	0.29a	0.09a
PYRAMITE	56.0	0.67a	0.67a	1.00a	0.33a	0.00a	0.43a
+ POLYRAM	3600.0						
PYRAMITE	112.0	0.33a	0.00a	0.67a	0.00a	0.20a	0.77a
+ POLYRAM	3600.0						
PYRAMITE	225.0	0.00a	0.33a	0.33a	0.00a	0.00a	0.26a
+ POLYRAM	3600.0						

Table 1. Continued.

Treatment	Rate	ERME	ERM	TSSME	TSSM	TPE	TP
	g [a.i.]/ha			20 July	15 Days		
Control		3.33a	0.33a	9.34a	5.00a	0.29a	1.20a
PYRAMITE	56.0	0.00b	0.00b	0.67b	0.33b	0.00b	0.51bc
PYRAMITE	112.0	0.00b	0.00b	2.00b	0.33b	0.00b	0.17cd
PYRAMITE	225.0	0.00b	0.00b	0.33b	0.00b	0.00b	0.00d
PYRAMITE	56.0	0.00b	0.00b	1.33b	0.67b	0.00b	0.52b
+ POLYRAM	3600.0						
PYRAMITE	112.0	0.33b	0.00b	1.33b	1.00b	0.10b	0.26bcd
+ POLYRAM	3600.0						
PYRAMITE	225.0	0.67b	0.00b	0.00b	0.33b	0.00b	0.26bcd
+ POLYRAM	3600.0						
				26 July	21 Days		
Control		3.33a	0.00a	3.67a	2.00a	0.20a	1.12a
PYRAMITE	56.0	0.00b	0.33a	1.33a	0.33a	0.20a	0.52ab
PYRAMITE	112.0	0.00b	0.00a	0.67a	2.00a	0.10a	0.28b
PYRAMITE	225.0	0.00b	0.00a	0.67a	0.33a	0.10a	0.00b
PYRAMITE	56.0	0.33b	0.00a	2.67a	0.33a	0.10a	0.17b
+ POLYRAM	3600.0						
PYRAMITE	112.0	0.00b	0.00a	0.67a	0.33a	0.00a	0.17b
+ POLYRAM	3600.0						
PYRAMITE	225.0	0.33b	0.00a	0.33a	1.00a	0.00a	0.00b
+ POLYRAM	3600.0						
				5 August	31 Days		
Control		1.69a	0.33a	0.00b	0.67a	0.21a	0.71a
PYRAMITE	56.0	0.33ab	0.00a	0.67ab	0.00a	0.10a	0.26ab
PYRAMITE	112.0	0.00b	0.00a	2.33ab	0.00a	0.29a	0.26ab
PYRAMITE	225.0	0.33ab	0.00a	3.33ab	1.33a	0.20a	0.00b
PYRAMITE	56.0	1.00ab	0.33a	1.67ab	0.33a	0.00a	0.26ab
+ POLYRAM	3600.0						
PYRAMITE	112.0	0.00b	0.00a	1.92ab	0.98a	0.00a	0.42ab
+ POLYRAM	3600.0						
PYRAMITE	225.0	0.00b	0.33a	3.72a	1.69a	0.00a	0.09ab
+ POLYRAM	3600.0						
				12 August	38 Days		
Control		3.00a	0.00a	1.00a	1.00a	0.10a	0.77a
PYRAMITE	56.0	0.00b	0.00a	0.67a	0.67a	0.10a	0.26a
PYRAMITE	112.0	0.00b	0.00a	0.72a	0.69a	0.00a	0.00a
PYRAMITE	225.0	0.69b	0.36a	2.33a	0.67a	0.00a	0.26a
PYRAMITE	56.0	0.00b	0.00a	1.67a	0.67a	0.10a	0.60a
+ POLYRAM	3600.0						
PYRAMITE	112.0	0.67b	0.67a	3.33a	0.67a	0.00a	0.17a
+ POLYRAM	3600.0						
PYRAMITE	225.0	0.00b	0.00a	2.00a	1.00a	0.00a	0.00a
+ POLYRAM	3600.0						

2000 PMR REPORT # 8 **SECTION A: INSECT PESTS OF FRUIT**

CROP: Apple, var. Spartan, Red Delicious, Golden Delicious, and McIntosh
PESTS: Oblique-banded leafroller (OBLR), *Choristoneura rosaceana* (Nort.)
Threelined leafroller (TLLR), *Pandemis limitata* (Rob.)
Fruittree leafroller (FTLR), *Archips argyrospila* (Wlk.)

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TITLE: EFFICACY OF BIOPROTEC™ AGAINST LEAFROLLERS ON APPLE

MATERIALS: BIOPROTEC™ (12.7 BIU *Bacillus thuringiensis* var. *kurstaki*/L), DIPEL™ DF (32 BIU *Bacillus thuringiensis* var. *kurstaki*/Kg), GUTHION™ 50 WP (50% azinphos-methyl), CONFIRM™ 240F (tebufenozide)

METHODS: This trial was conducted near Kelowna, BC in a 16-ha apple orchard with a mixture of apple varieties and planting densities. The three treatments (see Table 1 for rates and application dates) were replicated 3 times (minimum of 1 ha plots) and applied using an air-blast orchard sprayer calibrated to deliver 934 L of spray mixture/ha. Seven trees were left as unsprayed checks away from the treatment plots. DIPEL™ and BIOPROTEC™ were applied during bloom and again at petal fall; GUTHION™ was applied at pink and petal fall. Weather conditions were favourable (calm, 15-18°C) at the time of treatment applications, however between 5-10 mm of rain fell within 6 hours of the May 3 application of the first BIOPROTEC™ replicate. At 11-14 days after application, 500 blossom/fruit clusters in the upper half of the tree canopy were examined in each plot and in the check trees for the presence of live leafroller larvae. Tebufenozide (CONFIRM™ 240F) was applied at a rate of 1 L product/ha on July 1-3 and repeated on July 15-17, 20th to control the summer generation of OBLR and TLLR larvae. The proportion of fruit damaged by the spring and summer generation of larvae was assessed August 31 by examining 1000 fruit per plot (100 fruit from each of 10 standard trees; 50 fruit from each of 20 dwarf trees; 100 from each of the 7 check trees). The larva abundance and damage data from the treated plots were analyzed using ANOVA and the means compared using Student-Neuman Kuel's MRT.

RESULTS: See Table 1. DIPEL™ DF was incorrectly applied at 110 BIU/ha rather than the planned 50 BIU/ha. There was no significant difference among the treatments in the number of live larvae/500 clusters after the first application, however the number of live larvae was significantly lower in the BIOPROTEC™ and DIPEL™ plots than in the GUTHION™ plots after the second application. There was no significant difference in the mean % fruit damage among the treatments, however 3-4 times more fruit was damaged in the GUTHION™ plots than in the DIPEL™ or BIOPROTEC™ plots. Much of the fruit damaged by the spring generation (early damage) was likely removed during fruit thinning. In the 7 untreated trees, 16.2% and 18.6% of the terminals were infested May 10 and 29th respectively; early season and late season damage in the untreated check trees was 2.57% and 19.71% respectively. No live larvae were found during the fruit damage assessment.

CONCLUSIONS: The efficacy of BIOPROTEC™ against the spring generation of OBLR, TLLR and FTLR larvae and its crop protection performance when applied twice at 50 BIU/ha is not significantly different than that of DIPEL™ DF applied twice at 111 BIU/ha under the experimental conditions of this field study.

Table 1. Number of live leafroller larvae found in 500 flower/fruit clusters per treatment (average of three replicates/treatment) 11-14 DAT and proportion of 1000 fruit damaged per treatment.

Treatment	Rate/ha	First application	Ave. no. larvae[1]	Second application	Ave. no. larvae[1]	% early damaged fruit[1]	% late damaged fruit[1]
GUTHION™WP	2.72 kg	26 April	10.67a	16, 18 May	7.07a	1.70a	9.17a
DIPEL™ DF	111 BIU	4 May	3.33a	15, 18 May	0.13b	0.59a	2.16a
BIOPROTEC™	50 BIU	3-4 May	8.00a	15, 18 May	0.60b	1.77a	3.77a

[1] Values followed by the same letter are not significantly different ($p>0.05$).

2000 PMR REPORT # 9

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. McIntosh
PESTS: Codling moth, *Cydia pomonella* (L.)
Plum curculio, *Conotrachelus nenuphar* (Herbst)
Spotted tentiform leafminer, *Phyllonorycter blancardella* (F.)
PREDATORS: *Amblyseius fallacis* (Garman), *Balaustium putmani* Smiley, *Zetzelia mali* (Ewing)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST CODLING MOTH, PLUM CURCULIO, AND SPOTTED TENTIFORM LEAFMINER ON APPLE, 2000. I.

MATERIALS: CONFIRM 240F (tebufenozide), RH 2485 240 F (methoxyfenozide), RH 2485 80 WP (methoxyfenozide)

METHODS: The trial was conducted in a five-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 3.0 m by 4.8 m, and were on M26 rootstock. Treatments were replicated four times and assigned to two-tree plots, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male codling moths (CM). Treatments were applied 12 June for the first generation, 130 degree-days (DD) (base 10°C) after first male CM catch; treatments were reapplied 30 June, 295 DD (base 10C) after first application. Timing for the second generation was based on peak catches of male CM in pheromone traps; treatments were applied 24 July, 225 DD (base 10°C) after the second application, and reapplied 15 August, 250 DD (base 10°C) after the third application. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were first sampled 7 July; 100 apples per plot were examined on the tree for plum curculio (PC) damage. A sample was taken to assess first generation codling moth (CM) damage on 14 July, when 100 apples per plot were examined on the tree. Second generation CM damage was assessed on 14 August when 100 apples per plot were examined on the tree. On 12 September; a total of 100 apples per plot were harvested from the canopy and the ground, and examined for CM damage. Efficacy was expressed as percent fruit damaged by CM or PC. Plots were sampled 5 October for effects on spotted tentiform leafminer (STLM) and beneficial mites; counts were made on 25 leaves per plot, picked randomly at arms length into the canopy. Leaves were examined using a stereomicroscope, and numbers of STLM mines/leaf and beneficial mites/leaf were recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1- 4. No phytotoxic effects were observed in any of the plots.

CONCLUSIONS: In the 14 July sample for first generation CM damage, all treated plots showed significantly lower damage than the control (Table 1). All treatments significantly reduced CM damage in the second generation sample taken 14 August. The 12 September harvest sample showed similar results; all treated plots showed lower CM damage than the control. Although application timing was based on CM phenology, the effects of treatments on levels of PC damage were also examined. In the sample taken 7 July to assess the effects of the first generation applications on PC, none of the treatments were significantly different from the control (Table 2). All plots treated with the 240 g ai/ha rate of RH 2485 showed significantly fewer STLM mines per leaf than both the control and those treated with CONFIRM; the plots treated with the 120 g ai/ha rate of RH 2485 and CONFIRM showed significantly fewer leaves with STLM mines than the control (Table 3). Numbers of beneficial mites were not significantly different from the control in any of the treated plots (Table 4).

Table 1. Percent fruit damaged by codling moth.

Treatment[1]	Rate (a.i./ha)	Gen. 1 14 July	Gen. 2 14 August	Harvest 12 September
RH 2485 80 WP	240 g	0.25 b[2]	2.25 b	9.5 b
RH 2485 240 F	240 g	1.75 b	4.25 b	6.9 b
CONFIRM 240F	240 g	1.75 b	3.75 b	8.9 b
RH 2485 240 F	120 g	3.25 b	4.25 b	8.9 b
CONTROL	-	17.50 a	16.5 a	40.5 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Percent fruit damaged by plum curculio.

Treatment[1]	Rate (a.i./ha)	36713
RH 2485 80 WP	240 g	13.50 a[2]
RH 2485 240 F	240 g	13.75 a
CONFIRM 240F	240 g	19.25 a
RH 2485 240 F	120 g	17.50 a
CONTROL	-	19.75 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 3. Spotted tentiform leafminer mines per leaf.

Treatment[1]	Rate (a.i./ha)	36803
RH 2485 80 WP	240 g	4.1 c[2]
RH 2485 240 F	240 g	3.4 c
CONFIRM 240F	240 g	6.1 b
RH 2485 240 F	120 g	4.6 bc
CONTROL	-	8.3 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August.

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 4. Beneficial mites per leaf.

Treatment[1]	Rate (a.i./ha)	*A. fallacis*	*Balaustium putmani*	*Zetzelia mali*	Total beneficial mites
RH 2485 80 WP	240 g	0.20 a[2]	0.01 a	0.02 a	0.23 a
RH 2485 240 F	240 g	0.33 a	0.01 a	0.01 a	0.35 a
CONFIRM 240 F	240 g	0.21 a	0.01 a	0.01 a	0.23 a
RH 2485 240 F	120 g	0.17 a	0.00 a	0.00 a	0.17 a
CONTROL	-	0.16 a	0.00 a	0.01 a	0.17 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August; sampled 5 October.

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2000 PMR REPORT # 10 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. McIntosh
PESTS: Codling moth, *Cydia pomonella* (L.)
Plum curculio, *Conotrachelus nenuphar* (Herbst)
Spotted tentiform leafminer, *Phyllonorycter blancardella* (F.)
PREDATORS: *Amblyseius fallacis* (Garman), *Balaustium putmani* Smiley, *Zetzelia mali* (Ewing)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST CODLING MOTH, PLUM CURCULIO, AND SPOTTED TENTIFORM LEAFMINER ON APPLE, 2000. II.

MATERIALS: EXP 61486A 70 WP (acetamiprid), GUTHION 50 WP (azinphos-methyl)

METHODS: The trial was conducted in a 28-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 2.5 m by 4.6 m, and were on M26 rootstock. Treatments were replicated three times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male codling moths (CM); sticky traps were checked twice weekly from May through September. Three rates of EXP 61486A were examined with GUTHION applied as a standard. Treatments were applied 12 June for the first generation, 130 DD (base 10C) after first male CM catch; treatments were reapplied 30 June, 170 DD (base 10C) after first application. Timing for the second generation was based on peak catches of male CM in pheromone traps; treatments were applied 24 July and reapplied 15 August. Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-11 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled to assess first generation codling moth (CM) damage on 14 July, when 100 apples per plot were examined on the tree. On 17 July, 100 apples per plot were examined on the tree for plum curculio (PC) damage. Second generation CM damage was sampled on 14 August; 100 apples per plot were examined on the tree. On 13 September, a total of 100 apples per plot were harvested from the canopy and the ground and examined for CM damage. Data were expressed as percent fruit damaged by CM or PC. Plots were sampled 5 October for effects on spotted tentiform leafminer (STLM) and beneficial mites; counts were made on 25 leaves per plot picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope and numbers of STLM mines/leaf and beneficial mites/leaf were recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1-4. No phytotoxic effects were observed. Male CM were caught in traps into September, well past the last application 15 August.

CONCLUSIONS: In the 14 July sample for first generation CM damage, all treated plots showed significantly lower damage than the control. All treatments significantly reduced CM damage in the second generation sample taken 14 August. The 13 September harvest sample showed similar results: all treated plots showed lower CM damage than the control. Although application timing was based on CM phenology, the effects of treatments on levels of PC damage and STLM infestations were also examined. In the sample taken 17 July to assess the effects of the first application on PC, none of the treatments were significantly lower than the control. All plots treated with EXP 61486A showed significantly fewer leaves with STLM mines than both the control and those treated with GUTHION; the plots treated with GUTHION showed significantly fewer leaves with STLM mines than the control. Numbers of beneficial mites were not significantly different from the control in any of the treated plots.

Table 1. Percent fruit damaged by codling moth.

Treatment[1]	Rate (a.i./ha)	% fruit damaged		
		Gen. 1 14 July	Gen. 2 14 August	Harvest 13 September
GUTHION 50 WP	1.05 kg	0.3 b[2]	2.3 b	5.9 b
EXP 61486A 70 WP	168 g	0.3 b	2.0 b	3.6 b
EXP 61486A 70 WP	112 g	1.3 b	0.3 b	6.0 b
EXP 61486A 70 WP	84 g	1.7 b	1.0 b	8.6 b
CONTROL	-	13.3 a	17.0 a	33.3 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

Table 2. Percent fruit damaged by plum curculio.

Treatment[1]	Rate (a.i./ha)	% fruit damaged (17 July)
GUTHION 50 WP	1.05 kg	17.7 a[2]
EXP 61486A 70 WP	168 g	26.0 a
EXP 61486A 70 WP	112 g	21.3 a
EXP 61486A 70 WP	84 g	26.0 a
CONTROL	-	26.3 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

Table 3. Spotted tentiform leafminer mines per leaf.

Treatment[1]	Rate (a.i./ha)	36803
GUTHION 50 WP	1.05 kg	1.65 b[2]
EXP 61486A 70 WP	168 g	0.00 c
EXP 61486A 70 WP	112 g	0.04 c
EXP 61486A 70 WP	84 g	0.04 c
CONTROL	-	8.12 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

Table 4. Beneficial mites per leaf.

Treatment[1]	Rate (a.i./ha)	*A. fallacis* 5 October	*Balaustium putmani* 5 October	*Zetzelia mali* 5 October	Total beneficial mites 5 October
GUTHION 50 WP	1.05 kg	0.71 a[2]	0.01 a	0.01 a	0.73 a
EXP 61486A 70 WP	168 g	0.77 a	0.01 a	0.01 a	0.79 a
EXP 61486A 70 WP	112 g	0.63 a	0.03 a	0.00 a	0.66 a
EXP 61486A 70 WP	84 g	0.73 a	0.01 a	0.03 a	0.77 a
CONTROL	-	0.77 a	0.00 a	0.01 a	0.78 a

[1] Applied 12 June, reapplied 30 June, 24 July, 15 August.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 11 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Idared
PESTS: Spotted tentiform leafminer, *Phyllonorycter blancardella* (F.)
Mullein leaf bug, *Campylomma verbasci* (Meyer)
Rosy apple aphid, *Dysaphis plantaginea* (Passerini)
PARASITOIDS: *Pholetesor ornigis, Sympiesis spp.* (*Hymenoptera: Chalcidoidea*)

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TITLE: CONTROL OF FIRST GENERATION SPOTTED TENTIFORM LEAFMINER, MULLEIN LEAF BUG, AND ROSY APPLE APHID ON APPLE WITH THIAMETHOXAM, 2000

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a ten-year-old orchard in the Simcoe, Ontario area; trees cv. Idared were spaced 4.8 m by 7.2 m, and were on MM106 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Two rates at two different application timings were tested for ACTARA, one applied at pink (3 May); the second at petal fall (17 May), timed for egg hatch of the first generation of spotted tentiform leafminer (STLM). All treatments were compared with ADMIRE and a MATADOR standard, applied at petal fall (17 May). Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 14-15 L of spray mix were used per plot; pressure was set at 2000 kPa. On 7 June, plots were examined for Mullein leaf bug (MB) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs on tapping trays. Numbers of MB per six taps were recorded for each plot. On 7 June, plots were also examined for rosy apple aphid (RAA); total number of RAA colonies found in each plot were recorded. On 14 June, all clusters containing STLM mines were collected and total number of STLM mines were recorded. Samples were examined using a stereomicroscope and the total number of clusters mined by STLM was recorded. The presence of the parasitoids *Pholetesor ornigis* and *Sympiesis* spp. (Hymenoptera: Chalcidoidea) in mines was also recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Prespray samples 20 May showed similar numbers of STLM larvae (approximately 0.25 larvae/cluster) in all plots. No phytotoxic effects were observed in any of the treated plots. First generation STLM infestation was considered light.

CONCLUSIONS: In the sample taken 14 June to assess the effects of treatments on STLM, all treated plots had significantly fewer mines than the control but were not different from each other (Table 1). Numbers of mines parasitised by *P. ornigis* or *Sympiesis spp* were too few for statistical analysis, but parasitoids were present in all plots. In the 7 June sample for MB, all treated plots showed significantly lower numbers of MB than the control (Table 2); however, the 96 g ai/ha and 79 g ai/ha treatments were significantly lower than the 48 g ai/ha ACTARA treatment applied at pink. Numbers of RAA colonies in all treated plots were lower than the control, but treatments were not different each other.

Table 1. Effects on spotted tentiform leafminer.

Treatment	Rate (a.i./ha)	Number of STLM mines/plot (14 June)
ACTARA 25 WG[1]	96 g	2.00 b[3]
ACTARA 25 WG[1]	79 g	5.25 b
ACTARA 25 WG[2]	79 g	7.50 b
ACTARA 25 WG[2]	48 g	6.0 b
ADMIRE 240 F[1]	91.2 g	1.25 b
MATADOR 120 EC[1]	10 g	2.25 b
CONTROL	-	20.0 a

[1] Applied 17 May (petal fall).
[2] Applied 3 May (pink)
[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

Table 2. Effects of insecticides on numbers of Mullein leaf bug and rosy apple aphid.

Treatment	Rate (a.i./ha)	RAA Colonies/plot 7 June	MB/6 taps per plot 7 June
ACTARA 25 WG[1]	96 g	0.00 b	0.25 c[3]
ACTARA 25 WG[1]	79 g	0.25 b	2.50 c
ACTARA 25 WG[2]	79 g	0.25 b	2.00 c
ACTARA 25 WG[2]	48 g	0.25 b	7.00 b
ADMIRE 240 F[1]	91.2 g	0.25 b	4.50 bc
MATADOR 120 EC[1]	10 g	0.50 b	3.75 bc
CONTROL	-	6.25 a	20.75 a

[1] Applied 17 May (petal fall).
[2] Applied 3 May (pink)
[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 12

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP:	Apples cv. McIntosh
PEST:	Spotted tentiform leafminer, *Phyllonorycter blancardella* (F.)
PARASITOIDS:	*Pholetesor ornigis, Sympiesis spp.* (*Hymenoptera: Chalcidoidea*)
PREDATOR:	*Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF FIRST GENERATION SPOTTED TENTIFORM LEAFMINER ON APPLE WITH THIAMETHOXAM, 2000

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid)

METHODS: The trial was conducted in a five-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 4.8 m by 3.0 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Two rates of ACTARA were tested at two timings, one applied at pink (5 May); the second at petal fall (23 May) timed for egg hatch of the first generation of Spotted Tentiform Leafminer (STLM). All treatments were compared with an ADMIRE standard applied at petal fall (23 May). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. On 8 May, a sample of 40 leaf clusters per plot was collected from the lower central part of the tree canopy. Samples were examined using a stereomicroscope and the number of STLM eggs per cluster was recorded; total numbers of beneficial mites observed were also recorded for each plot. Plots were sampled again 20 June when 40 clusters per plot were collected and examined with a stereomicroscope; the percentage of clusters mined by STLM was recorded. The percentage of mines containing the parasitoids *Pholetesor ornigis* and *Sympiesis* spp. (Hymenoptera: Chalcidoidea) was also recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in tables 1 and 2. Prespray samples 19 May showed similar numbers of STLM larvae (approximately 0.5 larvae/cluster) in all plots; egg hatch was estimated to be 65% at the time of the petal fall application. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the sample taken 8 May, none of the treated plots were significantly different from the control (Table 1); none of the treatments exhibited any effects on populations of beneficial mites (predominately *A. fallacis*) (Table 2). In the 20 June sample to assess the effects of treatments on STLM, all treatments reduced the percentage of clusters mined by STLM, but the ADMIRE treatment was lower than all of the other treatments except for the 96 g ai/ha ACTARA treatment (Table 1). None of the treatments reduced parasitism of mines by either *P. ornigis* or *Sympiesis spp.*

Table 1. Effects on spotted tentiform leafminer and parasitoids.

Treatment	Rate (a.i./ha)	STLM Eggs/Cluster 8 May	% mined clusters 20 June	% mines parasitised 20 June
ACTARA 25 WG[1]	96 g	0.625 a[3]	35.5 bc	8.4 a
ACTARA 25 WG[1]	79 g	1.050 a	46.1 b	14.3 a
ACTARA 25 WG[2]	79 g	0.700 a	37.4 b	3.5 a
ACTARA 25 WG[3]	48 g	0.575 a	49.7 b	6.7 a
ADMIRE 240 F[1]	91.2 g	0.925 a	19.4 c	12.8 a
CONTROL	-	0.600 a	76.1 a	15.1 a

[1] Applied 23 May (petal fall).

[2] Applied 5 May (pink)

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on predaceous mites.

Treatment	Rate (a.i./ha)	Predators/cluster 20 June
ACTARA 25 WG[1]	96 g	0.450 a[3]
ACTARA 25 WG[1]	79 g	0.425 a
ACTARA 25 WG[2]	79 g	0.725 a
ACTARA 25 WG[2]	48 g	0.400 a
ADMIRE 240 F[1]	91.2 g	0.600 a
CONTROL	-	0.225 a

[1] Applied 23 May (petal fall).

[2] Applied 5 May (pink).

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2000 REPORT # 13

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Empire
PEST: White apple leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: CONTROL OF WHITE APPLE LEAFHOPPER WITH IMIDACLOPRID, 2000

MATERIALS: ADMIRE 240 F (imidacloprid)

METHODS: The trial was conducted in a mature orchard in the Waterford, Ontario area; trees cv. Empire were spaced 3.0 m by 5.5 m and were on M26 rootstock. Treatments were replicated four times and assigned to one-tree plots and arranged according to a randomised complete block design. Blocks were sampled pre-treatment and individual plots sampled 4, 7, and 15 days after treatment. Samples consisted of 30 leaves per plot, picked from the lower-central branches of the tree; leaves were examined using a stereomicroscope and numbers of living white apple leafhopper (WALH) nymphs recorded. On 21 August, insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Pre-treatment samples 21 August showed similar numbers of WALH nymphs (approximately 1.5 nymphs per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In each of the 4, 7, and 15 day samples, numbers of nymphs in the plots treated with ADMIRE were significantly lower than the control (Table 1).

Table 1. Effect of ADMIRE on WALH nymphs.

Treatment[1]	Rate a.i./ha	Number of WALH nymphs per leaf at Days After Treatment		
		4 Days (25 August)	7 Days (28 August)	15 Days (5 September)
ADMIRE 240 F	48.0 g	0.04 b[2]	0.05 b	0.03 b
CONTROL	-	1.85 a	2.67 a	1.57 a

[1] Applied 21August.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 14 **SECTION A: INSECT/MITE PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: European red mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF EUROPEAN RED MITE ON APPLE WITH ACARICIDES, 2000

MATERIALS: ASSISTOR (oil/emulsifier blend), FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a ten-year-old orchard in the Grimsby, Ontario area; trees cv. Red Delicious were spaced 2.0 m by 3.5 m and were on M26 rootstock. Two rates of ASSISTOR (1% and 2% of the total spray volume) were compared to two rates of FLORAMITE (280.3 g ai/ha and 560.7 g ai/ha), a PYRAMITE standard, a water-sprayed check, and an unsprayed control. Treatments were replicated four times, assigned to one-tree plots and arranged according to a randomised complete block design. On 3 August, acaricides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Blocks were sampled pre-treatment and individual plots sampled 7, 14, and 21 days after treatment. Samples consisted of counts made on 25 leaves per plot picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope (leaves were brushed with a Henderson-McBurnie mite brushing machine) and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) recorded. Total numbers of beneficial mites observed were also recorded for each plot. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Pre-treatment samples 3 August showed similar numbers of ERM motiles (approximately 175 motiles per leaf) in all plots. Phytotoxic effects were observed in the plots treated with ASSISTOR; older leaves exhibited early senescence, turning yellow and prematurely falling from the tree. These symptoms were similar to leaf burn symptoms resulting from summer oil applications. Fruit also showed phytotoxic damage in the ASSISTOR plots; ring-like markings were evident on the bottom of affected apples. These effects were not quantified but seemed to be more severe in the 2% ASSISTOR plots than the 1% ASSISTOR plots.

CONCLUSIONS: In the 7 day sample, all of the treated plots had significantly fewer ERM motiles than the unsprayed check (Table 1); only plots treated with ASSISTOR and PYRAMITE had significantly fewer ERM motiles than the water check. The 280.3 g ai/ha rate of FLORAMITE was the only treatment not different from the control in the 14 day sample but it was not different from the 560.7 g ai/ha rate of FLORAMITE or the 1% rate of ASSISTOR. The 2% rate of ASSISTOR was significantly different from all other treatments, except for the PYRAMITE treatment, which was significantly lower than all other treatments. Similar results were observed in the 21 day sample; numbers of motiles were significantly lower than the control in all of the treatments except for the 280.3 g ai/ha FLORAMITE treatment, which was not different from the 560.7 g ai/ha FLORAMITE or 1% ASSISTOR treatments. The plots treated with the 2% rate of ASSISTOR had fewer ERM than all treatments except for PYRAMITE, which had the lowest number of ERM. No differences in beneficial mite numbers were observed in any of the plots.

Table 1. Effect of treatments on ERM motiles.

Treatment[1]	Rate a.i./ha	Number of ERM motiles per leaf at Days After Treatment		
		7 days (Aug. 10)	14 days (Aug. 17)	21 days (Aug. 24)
FLORAMITE 50 W	560.7 g	98.2 bc[2]	61.9 c	40.3 c
FLORAMITE 50 W	280.3 g	106.9 bc	106.6 bc	74.1 bc
ASSISTOR	2% v/v	35.1 c	25.7 d	20.9 d
ASSISTOR	1% v/v	59.8 c	60.8 c	53.4 c
PYRAMITE 75 WP	225 g	19.3 c	7.4 e	5.4 e
WATER	-	245.2 ab	195.3 ab	160.4 a
CONTROL	-	311.6 a	274.0 a	140.3 ab

[1] Applied 3 August.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

Table 2. Effect of treatments on beneficial mites.

Treatment[1]	Rate a.i./ha	Number of beneficial mites per leaf at Days After Treatment		
		7 days (Aug. 10)	14 days (Aug. 17)	21 days (Aug. 24)
FLORAMITE 50 W	560.7 g	0.7 a[2]	0.5 a	2.2 a
FLORAMITE 50 W	280.3 g	0.6 a	0.3 a	5.1 a
ASSISTOR	2% v/v	0.3 a	0.9 a	2.0 a
ASSISTOR	1% v/v	0.5 a	1.7 a	9.1 a
PYRAMITE 75 WP	225 g	0.9 a	1.6 a	14.0 a
WATER	-	0.2 a	1.4 a	3.1 a
CONTROL	-	0.2 a	0.9 a	2.8 a

[1] Applied 3 August.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 15 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: Oblique-banded leaf roller, *Choristoneura rosaceana* (Harris)

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TITLE: CONTROL OF OVERWINTERED OBLIQUE-BANDED LEAF ROLLER ON APPLE, 2000

MATERIALS: CONFIRM 240F (tebufenozide), RH 2485 240F (methoxyfenozide)

METHODS: The trial was conducted in a 25-year-old orchard in the Grimsby, Ontario area; trees cv. Red Delicious were spaced 1.5 m by 3.0 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots and arranged according to a randomised complete block design. Treatments were applied at petal fall (24 May), targeting overwintered (second to fourth instar) oblique-banded leaf roller (OBLR) larvae; two rates of RH 2485 were compared with CONFIRM and an unsprayed control. Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Treatments were inspected on 30 May and 6 June before OBLR larvae had reached the pupal stage; 50 terminals were examined per plot and the number of terminals containing live larvae was recorded. Efficacy ratings were expressed as percent terminals infested; due to an abnormally light crop, fruit damage was not assessed. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Unseasonably cool weather between application (24 May) and the 30 May sample prompted a second efficacy sample 6 June. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In both of the samples (30 May and 6 June), infestations were lower in all of the treated plots than in the control.

Table 1. Effect of insecticides on OBLR larvae

Treatment[1]	Rate (a.i./ha)	Percent terminals infested per plot	
		36675	36682
H 2485 240 SC	180.0 g	9.5 b[2]	5.0 b
RH 2485 240 SC	84.0 g	11.0 b	7.5 b
CONFIRM	240.0 g	18.0 b	9.5 b
CONTROL	-	40.0 a	39.5 a

[1] Applied 24 May.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 16 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: Oblique-banded leaf roller, *Choristoneura rosaceana* (Harris)

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TITLE: CONTROL OF SUMMER-GENERATION OBLIQUE-BANDED LEAF ROLLER ON APPLE WITH VARIOUS INSECTICIDES, 2000

MATERIALS: CONFIRM 240F (tebufenozide), DECIS 5EC (deltamethrin), GUTHION 50W (azinphos-methyl), RH 2485 240 F (methoxyfenozide)

METHODS: The trial was conducted in a 25-year-old orchard in the Grimsby, Ontario area; trees cv. Red Delicious were spaced 1.5 m by 3.0 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male moths. The trial compared two rates of RH2485 with CONFIRM, DECIS, GUTHION, and an unsprayed check for control of oblique-banded leaf roller (OBLR). Treatments were applied 22 June, 112 DD (base 6.1 °C) after first male moth catch, and repeated 12 days (4 July) after first application. Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. On 1 August, 100 terminals were examined per plot, and the number of terminals containing live larvae was recorded. Efficacy ratings were expressed as percent terminals infested. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 1 August sample of terminals, all of the treated plots showed significantly lower infestations than the control. None of the treatments were significantly different from the others.

Table 1. Effect of insecticides on OBLR.

Treatment	Rate (a.i./ha)	% Infested Terminals per plot 1 August
RH 2485 240F[1]	240 g	0.0 b[2]
RH 2485 240F	120 g	0.5 b
DECIS 5 EC	10 g	0.5 b
GUTHION 50W	1.05 kg	0.75 b
CONFIRM 240F	240 g	0.75 b
CONTROL	-	7.25 a

[1] Applied 22 June (112 DD from first male moth catch), reapplied 4 July

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 17 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: Oblique-banded leaf roller, *Choristoneura rosaceana* (Harris)

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TITLE: CONTROL OF OBLIQUE-BANDED LEAF ROLLER ON APPLE WITH INSECTICIDES, 2000

MATERIALS: DECIS 5EC (deltamethrin), GUTHION 50W (azinphos-methyl), ORTHENE 75 SP (acephate)

METHODS: The trial was conducted in a 25-year-old orchard in the Grimsby, Ontario area; trees cv. Red Delicious were spaced 1.5 m by 3.0 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male moths. The trial compared three rates of ORTHENE with DECIS, GUTHION, and an unsprayed check for control of oblique-banded leaf roller (OBLR). Treatments were applied 30 June, 212 DD (base 6.1°C) after first male moth catch and repeated 12 July (359 $DD_{6.1C}$ after first male moth catch), 12 days after first application. Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. On 1 August, 100 terminals were examined per plot and the number of terminals containing live larvae was recorded. Efficacy ratings were expressed as percent terminals infested; data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 1 August sample of terminals, only the plots treated with the 375 g ai/ha rate of ORTHENE did not show significantly lower infestations than the control. None of the treatments were significantly different from the others.

Table 1. Effect of insecticides on OBLR.

Treatment	Rate (a.i./ha)	% Infested Terminals per plot (1 Augus)
DECIS 5 EC SP[1]	10 g	0.50 b[2]
GUTHION 50 WP	1.05 kg	0.75 b
ORTHENE 75 SP	750 g	0.75 b
ORTHENE 75 SP	562.5 g	1.00 b
ORTHENE 75 SP	375 g	3.50 ab
CONTROL	-	5.75 a

[1] Applied 30 June (212 DD from first male moth catch), reapplied 12 July.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 18 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: Oblique-banded leaf roller, *Choristoneura rosaceana* (Harris)

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TITLE: CONTROL OF SUMMER-GENERATION OBLIQUE-BANDED LEAF ROLLER ON APPLE WITH *Bacillus thuringiensis*; 2000

MATERIALS: BIOPROTEC (*Bacillus thuringiensis*, subsp. *kurstaki*), DIPEL 2X (*Bacillus thuringiensis*, subsp. *kurstaki*)

METHODS: The trial was conducted in a 25-year-old orchard in the Grimsby, Ontario area; trees cv. Red Delicious were spaced 1.5 m by 3.0 m and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male moths. The trial compared two rates of BIOPROTEC with DIPEL 2X and an unsprayed check for control of oblique-banded leaf roller (OBLR). Treatments were applied at dusk 30 June, 212 DD (base 6.1°C) after first male moth catch, and repeated 12 days (12 July) after first application. The spreader/sticker ACTIVATE PLUS was added to the BIOPROTEC treatments at 0.1% of the total spray mix. Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. On 1 August, 100 terminals were examined per plot and the number of terminals containing live larvae was recorded. Efficacy ratings were expressed as percent terminals infested; data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 1 August sample of terminals, the plots treated with DIPEL 2X and the high rate of BIOPROTEC showed significantly lower terminal infestation than the control. The low rate of BIOPROTEC showed a reduction in infestation but was not significantly different from the control.

Table 1. Effect of treatments on OBLR.

Treatment	Rate (product/ha)	% terminals infested per plot. 1 August
DIPEL 2X[1]	1.125 kg	1.25 b[2]
BIOPROTEC	4.0 L	1.25 b
BIOPROTEC	2.8 L	2.5 ab
CONTROL	-	9.75 a

[1] Applied 30 June (212 DD from first male moth catch), reapplied 12 July

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 19 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. McIntosh
PESTS: Plum curculio, *Conotrachelus nenuphar* (Herbst)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST PLUM CURCULIO ON APPLE, 2000

MATERIALS: ACTARA 30 WG (thiamethoxam), GUTHION 50 WP (azinphos-methyl)

METHODS: The trial was conducted in a 2-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 3.0 m by 4.8 m, and were on M26 rootstock. Treatments were replicated four times, assigned to three-tree plots and arranged according to a randomised complete block design. Treatments were applied 30 May; application timing was determined from appearance of first fruit damage by plum curculio (PC) in the plots. A second application of ACTARA was made 13 June. Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled 5 June and 21 June (6 and 22 days after application, respectively); 100 apples per plot were examined on the tree for PC damage, and efficacy expressed as percent fruit damage. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in the table below. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 5 June and 21 June samples for PC damage, all treated plots showed significantly lower damage than the control.

Table 1. Effect of insecticides on plum curculio fruit damage.

Treatment	Rate (a.i./ha)	% fruit damaged by PC at days after application	
		5 June (6 days)	21 June (22 days)
GUTHION 50 WP[1]	1.05 kg	0.0 b[3]	14.6 b
ACTARA 30 WG[2]	79 g	4.1 b	5.7 b
CONTROL	-	34.0 a	36.2 a

[1] Applied 30 May.
[2] Applied 30 May, reapplied 13 June.
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2000 PMR REPORT # 20 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Apples cv. Golden Delicious
PEST: Spotted tentiform leafminer, *Phyllonorycter blancardella* (F.)
PARASITOIDS: *Pholetesor ornigis, Sympiesis spp.* (*Hymenoptera: Chalcidoidea*)

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TITLE: CONTROL OF FIRST GENERATION SPOTTED TENTIFORM LEAFMINER ON APPLE WITH VARIOUS INSECTICIDES, 2000

MATERIALS: CONFIRM 240 F (tebufenozide), MATADOR 120 EC (lambda cyhalothrin), RH 2485 80 WP

METHODS: The trial was conducted in a twenty-eight-year-old orchard in the Jordan, Ontario area; trees cv. Golden Delicious were spaced 2.5 m by 4.9 m and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Blocks were sampled pre-treatment 20 May, when three subsamples of 25 leaf clusters from the lower central canopy of trees in each block were examined for eggs and larvae of Spotted Tentiform Leafminer (STLM). Treatments were applied at petal fall (23 May), timed for 50% egg hatch of the first generation of STLM. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 13 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, a sample of 50 leaf clusters per plot was collected from the lower central part of the tree canopy. Samples were examined using a stereomicroscope and the percentage of clusters mined by STLM was recorded. The percentage of mines containing the parasitoids *Pholetesor ornigis* and *Sympiesis* spp. (Hymenoptera: Chalcidoidea) was also recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Prespray samples 20 May showed similar numbers of STLM larvae in all plots. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the sample taken 19 June to assess the effects of treatments on STLM, only the 180 g ai/ha rate of RH 2485 was significantly different from the CONFIRM treatment; all but the CONFIRM treatment were significantly different from the control. None of the treated plots showed significantly reduced parasitism of mines by either *P. ornigis* or *Sympiesis spp.*

Table 1. Effects on spotted tentiform leafminer and parasitoids 27 days after treatment.

Treatment[1]	Rate (a.i./ha)	% mined clusters 19 June	% mines parasitised 19 June
RH 2485 240F	180 g	19.7 c[2]	49.2 a
RH 2485 240F	90 g	21.6 bc	33.8 a
MATADOR 120 EC	10.0 g	34.2 bc	44.7 a
CONFIRM 240 F	240 g	42.0 ab	40.9 a
CONTROL	-	60.2 a	46.7 a

[1] Applied 23 May (petal fall).

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 21

SECTION A: INSECT/MITE PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Riesling
PEST: European red mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF EUROPEAN RED MITE ON GRAPE WITH ACARICIDES, 2000

MATERIALS: AGRI-MEK 1.9 EC (abamectin), FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a four-year-old vineyard in the Jordan Station, Ontario area; vines cv. Riesling were spaced 2.5 m by 1.5 m. Treatments were replicated four times, assigned to five-vine plots, and arranged according to a randomised complete block design. On 9 August, acaricides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. The spreader/sticker LI 700 was added to the AGRI-MEK treatment at 0.1% of the total spray volume. Blocks were sampled pre-treatment and individual plots sampled 7, 14, and 21 days after treatment. Samples consisted of counts made on 25 leaves per plot, picked randomly from both sides of the row. Leaves were examined using a stereomicroscope (leaves were brushed with a Henderson-McBurnie mite brushing machine), and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) recorded. Total numbers of beneficial mites observed in the 21 day sample (30 August) were also recorded for each plot. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Pre-treatment samples 9 August showed similar numbers of ERM motiles (approximately 15 motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots. Powdery mildew infestation was heavy in all plots.

CONCLUSIONS: In the 7 day sample, only plots treated with AGRI-MEK and PYRAMITE had significantly fewer ERM motiles than the control (Table 1). The same was true for the 14 day sample, but the 420.5 g ai/ha FLORAMITE treatment was not different from the AGRI-MEK or PYRAMITE treatments. In the 21 day sample, numbers of motiles in all of the treated plots were significantly lower than the control but treatments were not significantly different from each other. No differences in beneficial mite numbers were observed in any of the plots (Table 2).

Table 1. Effect of insecticides and a miticide on ERM motiles.

Treatment[1]	Rate a.i./ha	Number of ERM motiles per leaf at indicated days after treatment		
		7 days (16 August)	14 days (23 August)	21 days (30 August)
FLORAMITE 50 W	420.5 g	14.7 a[2]	9.6 ab	2.7 b
FLORAMITE 50 W	280.3 g	11.8 a	13.1 a	2.6 b
AGRI-MEK 1.9 EC[3]	10.64 g	3.3 b	0.7 b	0.4 b
PYRAMITE 75 WP	225 g	5.1 b	2.8 b	2.1 b
CONTROL	-	17.5 a	15.2 a	14.4 a

[1] Applied 9 August.
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.
[3] LI 700 added at 0.1% of the total spray mix.

Table 2. Effect of treatments on beneficial mites.

Treatment[1]	Rate a.i./ha	Number of beneficial mites per leaf at indicated days after treatment		
		7 days (16 August)	14 days (23 August)	21 days (30 August)
FLORAMITE 50 W	420.5 g	0.08 a[2]	0.01 a	0.06 a
FLORAMITE 50 W	280.3 g	0.08 a	0.01 a	0.00 a
AGRI-MEK 1.9 EC[3]	10.64 g	0.03 a	0.00 a	0.01 a
PYRAMITE 75 WP	225 g	0.00 a	0.05 a	0.05 a
CONTROL	-	0.18 a	0.21 a	0.08 a

[1] Applied 9 August.
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.
[3] LI 700 added at 0.1% of the total spray mix.

2000 PMR REPORT # 22 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Concord
PEST: Grape leafhopper, *Erythroneura comes* (Say)

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TITLE: CONTROL OF GRAPE LEAFHOPPER ON GRAPE WITH INSECTICIDES, 2000

MATERIALS: ADMIRE 240 F (imidacloprid), GUTHION 240 SC (azinphos-methyl)

METHODS: The trial was conducted in a mature vineyard in the Jordan, Ontario area; vines cv. Concord were spaced 2.7 m by 2.7 m. Treatments were replicated four times, assigned to three-vine plots, and arranged according to a randomised complete block design. Blocks were sampled pre-treatment and individual plots sampled 6, 14, and 23 days after treatment. Samples consisted of 20 leaves per plot, picked randomly from both sides of the row. Leaves were examined using a stereomicroscope and numbers of living grape leafhopper (GLH) nymphs recorded. On 11 July, insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Pre-treatment samples 10 July showed similar numbers of GLH nymphs (approximately 3.5 nymphs per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In all of the samples (6, 14, and 23 days after treatment), numbers of nymphs in all of the plots treated with GUTHION and ADMIRE were significantly lower than the control.

Table 1. Effect of insecticides on GLH nymphs.

Treatment[1]	Rate a.i./ha	Number of GLH nymphs per leaf at indicated day after treatment		
		6 Days (17 July)	14 Days (25 July)	23 Days (3 August)
ADMIRE 240 F	48.0 g	0.01 b[2]	0.00 b	0.02 b
ADMIRE 240F	38.4 g	0.00 b	0.01 b	0.02 b
GUTHION 240 SC	0.75 kg	0.29 b	0.10 b	0.16 b
CONTROL	-	3.34 a	2.85 a	4.59 a

[1] Applied 11 July.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 23

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Concord
PEST: Grape berry moth, *Endopzia viteana* (Clemens)

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TITLE: CONTROL OF GRAPE BERRY MOTH ON GRAPE WITH INSECTICIDES, 2000

MATERIALS: CONFIRM 240 F (tebufenozide), DIPEL 2X (*Bacillus thuringiensis*, subsp. *kurstaki*), DPX MP062 30 WG (indoxacarb), EXP 61486A 70 W (acetamiprid), GUTHION 240 SC (azinphos-methyl), PARATHION 960 EC (parathion), RH 2485 240 SC (methoxyfenozide), SUCCESS 480 F (spinosad)

METHODS: The trial was conducted in a mature vineyard in the Niagara-on-the-Lake, Ontario area; vines cv. Concord were spaced 3.0 m by 2.5 m. Treatments were replicated four times, assigned to five-vine plots, and arranged according to a randomised complete block design. Application timing was based on peak pheromone trap catch of male grape berry moths (GBM). On 25 July, insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were examined 18 August (23 days after application); 30 grape bunches per plot were examined on the vine for the presence of GBM. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 18 August sample, none of the treatments were significantly different from each other; however, the DIPEL, RH 2485, GUTHION, and PARATHION treatments showed a lower GBM infestation than the control.

Table 1. Percent grape bunches infested by grape berry moth 23 days after application.

Treatment[1]	Rate	% Infested Bunches (18 August)
PARATHION 960 EC	936 g a.i./ha	10.0 b[2]
GUTHION 240 SC	744 g a.i./ha	11.7 b
RH 2485 240 SC	240 g a.i./ha	12.5 b
DIPEL 2X	1.125 kg/ha	12.5 b
CONFIRM 240 F	240 g a.i./ha	15.0 ab
EXP 61486A 70 W	112 g a.i./ha	15.0 ab
SUCCESS 480 F	124.8 g a.i./ha	22.5 ab
DPX MP062 30 WG	75 g a.i./ha	23.3 ab
CONTROL	-	34.2 a

[1] Applied 25 July.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 24

SECTION A: INSECT/MITE PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF EUROPEAN RED MITE ON PEACH WITH VARIOUS ACARICIDES, 2000

MATERIALS: FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a nine-year-old orchard in the Jordan Station, Ontario, area; trees cv. Loring were spaced 4.6 m by 6.0 m. Treatments were replicated four times, assigned to one-tree plots, and arranged according to a randomised complete block design. Two rates of FLORAMITE were compared to a PYRAMITE standard and an unsprayed CONTROL. On 8 August, acaricides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled pre-treatment 8 August, and three times post-treatment, 15 August, 22 August, and 29 August (7, 14, and 21 days after treatment). Efficacy ratings consisted of counts of motiles of European Red Mite (ERM) on 50 leaves per plot, picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope (leaves were brushed with a Henderson-McBurnie mite brushing machine), and numbers of live ERM motiles (nymphs and adults) were recorded. Total numbers of beneficial mites (primarily *A. fallacis*) observed were also recorded for each plot. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2 below. Prespray samples 8 August showed similar numbers of ERM motiles (approximately 15 ERM motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 7 day sample, only the plots treated with the 280.3 g ai/ha rate of FLORAMITE did not have fewer ERM motiles than the control, while the 420.5 g ai/ha rate of FLORAMITE and the PYRAMITE treatments were significantly lower (Table 1). Numbers of ERM motiles per leaf in all treated plots were significantly lower than the control in the 14 day and 21 day samples but were not different from each other. None of the treatments had a significant effect on beneficial mites in the 7 or 14 day samples (Table 2); numbers of beneficial mites per leaf were significantly lower than the control in the PYRAMITE treated plots 21 days after treatment. Whether these late developing differences were due to toxic effects or a lack of prey was not determined.

Table 1. Numbers of ERM motiles per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		7 days 15 August	14 days 22 August	21 days 29 August
FLORAMITE 50 W	420.5 g	2.1 b[2]	1.0 b	0.14 b
FLORAMITE 50 W	280.3 g	7.5 a	5.8 b	2.23 b
PYRAMITE 75 WP	225 g	3.4 b	0.3 b	0.06 b
CONTROL	-	14.2 a	21.4 a	42.62 a

[1] Applied 8 August.
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

Table 2. Numbers of beneficial mites per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		7 days 15 August	14 days 22 August	21 days 29 August
FLORAMITE 50 W	420.5 g	0.000 a	0.10 a	0.07 a
FLORAMITE 50 W	280.3 g	0.075 a	0.34 a	0.18 a
PYRAMITE 75 WP	225 g	0.100 a	0.03 a	0.00 b
CONTROL	-	0.125 a	1.10 a	0.38 a

[1] Applied 8 August.
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 25 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: CONTROL OF ORIENTAL FRUIT MOTH ON PEACH WITH VARIOUS INSECTICIDES, 2000

MATERIALS: DECIS 5EC (deltamethrin), RH 2485 240 F (methoxyfenozide)

METHODS: The trial was conducted in a four-year-old orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 4.6 m by 5.5 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed for egg hatch of second generation, determined from pheromone trap catches of male moths. Treatments were applied 7 July, 660 DD (base 7.2 C) after first male moth catch. RH 2485 was applied as two treatments at different rates, 240 g ai/ha and 360 g ai/ha; a third treatment at 240 g ai/ha included the spreader/sticker AGRAL 90 at 0.1% of the total spray mix. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-11 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled post-treatment 20 July; all infested terminals and fruit were removed, and examined for the presence of live larvae. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1 below. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 20 July sample, only the DECIS and the 360 g ai/ha RH 2485 treatments showed a significant difference from the control. Infestations were considered heavy.

Table 1. OFM damage per plot.

Treatment	Rate (a.i./ha)	Infested Terminals per Plot 20 July	Damaged Fruit per Plot 20 July	Total OFM Damage 20 July
DECIS 5EC[1]	12.5 g	6.75 b	0.75 a	7.50 b[2]
RH 2485 240 F	360.0 g	15.75 b	0.75 a	16.50 b
RH 2485 240 F	240.0 g	31.25 ab	1.00 a	32.25 ab
RH 2485 240 F +AGRAL 90	240.0 g	49.25 ab	4.00 a	53.25 ab
CONTROL	-	74.75 a	2.50 a	77.25 a

[1] Applied 7 July.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 26

SECTION A: INSECT PESTS OF FRUIT
STUDY DATA BASE: 280-1261-9341

CROP: Pear cv. Bosc
PESTS: Pear psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA ON PEAR, 2000

MATERIALS: ACTARA 25 WG (thiamethoxam), AGRI-MEK 1.9 EC (abamectin)

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan, Ontario, area; trees cv. Bosc were spaced 5.4 m by 6.0 m. Treatments were replicated three times, assigned to two-tree plots, and arranged according to a randomised complete block design. On 25 May, insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. SUPERIOR 70 spray oil was added to the AGRI-MEK treatment at 0.25% of the total spray volume. Plots were sampled pre-treatment 24 May, and three times post-treatment, 30 May, 8 June, and 15 June (5, 14, and 21 days after treatment). Efficacy ratings consisted of counts of nymphs of pear psylla (PP) on 20 clusters per plot, picked randomly. Clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Prespray samples 24 May showed similar numbers of psylla nymphs (approximately 2.1 nymphs per cluster) in all plots. No phytotoxic effects were observed.

CONCLUSIONS: All of the treated plots had fewer PP nymphs per cluster than the control in each of the 5, 14, and 21 day samples; none of the treatments were significantly different from each other.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		5 days (30 May)	14 days (8 June)	21 days (15 June)
ACTARA 25 WG[1]	96 g	0.02 b[4]	0.05 b	0.08 b
ACTARA 25 WG[1]	79 g	0.17 b	0.10 b	0.25 b
ACTARA 25 WG[2]	79 g	0.28 b	0.02 b	0.10 b
AGRI-MEK 1.9 EC[1,3]	28.5 g	0.02 b	0.08 b	0.40 b
CONTROL	-	1.38 a	1.00 a	1.40 a

[1] Applied 25 May

[2] Applied 25 May, reapplied 8 June

[3] SUPERIOR 70 spray oil added at 0.25% of the total spray volume

[4] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 27 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Pear cv. Bartlett
PEST: Pear psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA ON PEAR WITH INSECTICIDES, 2000. I.

MATERIALS: ADMIRE 240F (imidacloprid), GUTHION 50WP (azinphos-methyl)

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan, Ontario, area; trees cv. Bartlett were spaced 5.4 m by 6.0 m. Treatments were replicated three times, assigned to two-tree plots, and arranged according to a randomised complete block design. Plots were sampled pre-treatment 24 May and three times post-treatment, 30 May, 8 June, and 15 June (5, 14, and 21 days after treatment). Efficacy ratings consisted of counts of nymphs of pear psylla (PP) on 20 clusters per plot, picked randomly. Clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. On 25 May, insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Prespray samples 24 May showed similar numbers of psylla nymphs (approximately 2.1 nymphs per cluster) in all plots. No phytotoxic effects were observed.

CONCLUSIONS: In the 30 May sample (5 days after application), numbers of PP nymphs per cluster were significantly lower than the control in plots treated with ADMIRE; numbers of nymphs per cluster were not different from the control in the GUTHION plots. All treated plots had fewer PP nymphs per cluster than the control in the 14 day sample. Only the ADMIRE treatment was not different from the control in the 21 day sample; however, the ADMIRE treatment was not different from the GUTHION treatment.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		5 days (30 May)	14 days (8 June)	21 days (15 June)
ADMIRE 240 F	180 g	0.12 b[2]	0.07 b	1.30 ab
GUTHION 50 WP	1.00 kg	0.87ab	0.10 b	0.98 b
CONTROL	-	3.28 a	1.78 a	2.30 a

[1] Applied 25 May.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 28 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Pear cv. French Bartlett
PESTS: Pear psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA ON PEAR WITH ASSISTOR, 2000.

MATERIALS: ASSISTOR (oil/emulsifier blend), MITAC 50 W (amitraz)

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan, Ontario, area; trees cv. French Bartlett were spaced 5.4 m by 6.0 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Plots were sampled pre-treatment 24 May, and twice post-treatment, 30 May and 8 June (5 and 14 days after treatment). Efficacy ratings consisted of counts of nymphs of pear psylla (PP) on 20 clusters per plot, picked randomly. Clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. On 25 May, insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Two rates of ASSISTOR (1% and 2% of the total spray volume) were compared to a MITAC standard, a water-only check, and an unsprayed control. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Prespray samples 24 May showed similar numbers of psylla nymphs (approximately 2.1 nymphs per cluster) in all plots. No phytotoxic effects were observed.

CONCLUSIONS: Numbers of psylla nymphs per cluster in all treated plots were not significantly lower than the control in the 5 day sample. Only the MITAC and 2% rate of ASSISTOR were different from the control in the 14 day sample, but neither of these treatments were significantly different from the 1% rate of ASSISTOR. The water check was not different from the control in either sample.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment[1]	Rate	Days After Treatment	
		5 days (30 May)	12 days (8 June)
ASSISTOR	2%	1.98 a[2]	0.44 b
ASSISTOR	1%	0.69 a	0.69 ab
MITAC 50W	1.25 kg ai/ha	1.89 a	0.14 b
WATER	-	1.71 a	1.94 a
CONTROL	-	2.53 a	1.91 a

[1] Applied 25 May.

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2000 PMR REPORT # 29 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 280-1261-9341

CROP: Pear cv. Bartlett
PESTS: Pear psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA WITH INSECTICIDES, 2000. II.

MATERIALS: ACTARA 30 WG (thiamethoxam), AGRI-MEK 1.9 EC (abamectin), DECIS 5 EC (deltamethrin), GUTHION 50 WP (azinphos-methyl), MITAC 50 W (amitraz), PYRAMITE 75 WP (pyridaben), THIODAN 50 WP (endosulfan)

METHODS: The trial was conducted in a three-year-old orchard in the Simcoe, Ontario, area; trees cv. Bartlett were spaced 5.4 m by 6.0 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Plots were sampled pre-treatment 19 June, and twice post-treatment, 28 June and 4 July (5 and 11 days after treatment). Efficacy ratings consisted of counts of nymphs of pear psylla (PP) on 20 clusters per plot, picked randomly. Clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. On 23 June, insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. SUPERIOR 70 spray oil was added to the AGRI-MEK treatment at 0.25% of the total spray volume. Data were transformed (log[x+1]), and analysed using analysis of variance; means were separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Prespray samples 19 June showed similar numbers of psylla nymphs (approximately 2.5 nymphs per cluster) in all plots. No phytotoxic effects were observed.

CONCLUSIONS: Numbers of psylla nymphs per cluster in all treated plots were significantly lower than the control in the both 5 day and 11 day samples.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment[1]	Rate (a.i./ha)	Days After Treatment	
		5 days (28 June)	11 days (4 July)
THIODAN 50W	3.375 kg	0.46 b[3]	0.01 b
GUTHION 50WP	1.05 kg	0.11 b	0.10 b
DECIS 5EC	17.5 g	0.59 b	0.14 b
PYRAMITE 75WP	450 g	0.10 b	0.00 b
AGRI-MEK 1.9EC[2]	19 g	0.34 b	0.21 b
MITAC 50W	1.25 kg	0.03 b	0.00 b
ACTARA 30WG	96	0.07 b	0.00 b
CONTROL	-	2.46 a	1.11 a

[1] Applied 23 June.

[2] SUPERIOR 70 spray oil added at 0.25% of the total spray volume

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2000 PMR REPORT # 30 **SECTION A: INSECT/MITE PESTS OF FRUIT STUDY DATA BASE:**

CROP: Plum, cv. Stanley
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch)
Two spotted spider mite (TSSM) *Tetranychus urticae* (Koch).
PREDATOR: *Typhlodromus pyri* Scheuten

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TITLE: COMPATIBILITY OF A NOVEL MITICIDE WITH SUPPRESSION OF EUROPEAN RED MITE AND TWO-SPOTTED SPIDER MITE BY *TYPHLODROMUS PYRI* ON PLUM, 1999

MATERIALS: CARZOL 92 SP (formetanate), KELTHANE 35 WP (dicofol), PYRAMITE 75 WP (pyridaben), BIFENAZATE 50 WP

METHODS: The trial was conducted on potted plum trees located at the Atlantic Food and Horticulture Research Centre in Kentville, Nova Scotia. Each of the five miticide treatments were applied by truck-mounted sprayer on 18 August, 1999. Plots or experimental units consisted of two adjacent, potted trees. Each treatment was applied to four 2-tree plots. Samples were collected as 3 leaves per tree, totalling 6 leaves per plot. Pesticides were diluted to a rate comparable to 3000 litres/ha. Samples were taken on the dates shown below and passed through a mite-brushing machine. The precount of 18 August, 1999 was taken the same day treatments were applied. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 3 leaves per plot). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the plate.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: Pretreatment counts 18 August indicated no significant variations among the different plots before miticide treatments were applied. Throughout the trial period, no significant differences were seen between any of the treatments for ERM, TSSM or a rust mite (ARM). By 5 days after treatment, *T. pyri* numbers were significantly lower in the CARZOL, KELTHANE and PYRAMITE treatments than in the control or either of the BIFENAZATE treatments. However, by 12 and 20 days after treatment, this difference was no longer noticeable.

Table 1. Densities of eggs (TPE) and active stages of *Typhlodromus pyri* (TP), eggs (ERME) and active stages (ERM) of European red mite, eggs (TSSME) and active stages (TSSM) of two spotted spider mite and active stages of a rust mite (ARM). For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

	Rate g[a.i./ha]	TPE	TP	ERME	ERM	TSSME	TSSM	ARM
				18 Aug.	Pre-Treatment			
Control		0.00a	0.00a	3.33a	0.00a	5.00a	0.00a	0.83a
CARZOL	1012	0.22a	0.22a	14.17a	4.17a	16.67a	3.33a	6.67a
BIFENAZATE	280	0.00a	0.43a	12.50a	0.00a	11.67a	4.17a	1.67a
BIFENAZATE	420	0.00a	0.22a	18.34a	3.33a	6.67a	4.17a	9.17a
KELTHANE	1575	0.00a	0.00a	11.67a	1.67a	5.83a	6.67a	15.00a
PYRAMITE	225	0.00a	0.43a	12.50a	1.67a	20.83a	13.33a	13.33a
				23 Aug.	5 Days			
Control		0.00a	0.22ab	5.00a	5.83a	10.84a	10.84a	14.17a
CARZOL	1012	0.00a	0.00b	1.67a	1.67a	0.83a	1.67a	0.00a
BIFENAZATE	280	0.00a	0.86a	1.67a	0.83a	0.83a	0.83a	24.17a
BIFENAZATE	420	0.00a	0.57ab	1.11a	1.11a	4.44a	0.00a	11.11a
KELTHANE	1575	0.43a	0.00b	3.33a	3.33a	23.33a	9.17a	29.17a
PYRAMITE	225	0.00a	0.00b	4.17a	1.67a	14.17a	5.00a	1.67a
				30 Aug.	12 Days			
Control		0.00a	0.22a	4.17a	0.83a	0.83a	0.83a	0.83a
CARZOL	1012	0.00a	0.00a	3.34a	0.00a	0.00a	0.00a	0.00a
BIFENAZATE	280	0.00a	0.22a	1.67a	0.00a	0.00a	0.00a	0.00a
BIFENAZATE	420	1.29a	0.00a	0.83a	0.83a	0.00a	0.00a	0.00a
KELTHANE	1575	0.00a	0.22a	9.17a	3.33a	5.00a	1.67a	0.00a
PYRAMITE	225	0.00a	0.00a	0.00a	0.00a	0.83a	2.50a	0.00a
				7 Sept.	20 days			
Control		0.00a	0.22a	0.00a	0.83a	0.83a	0.83a	0.00a
CARZOL	1012	0.00a	0.00a	0.83a	0.83a	0.83a	0.83a	0.00a
BIFENAZATE	280	0.00a	0.22a	0.83a	0.83a	0.00a	0.00a	0.00a
BIFENAZATE	420	0.00a	0.00a	0.00a	0.83a	0.00a	0.00a	0.00a
KELTHANE	1575	0.22a	0.43a	3.34a	0.00a	1.67a	1.67a	0.83a
PYRAMITE	225	0.00a	0.00a	0.00a	0.00a	0.83a	0.83a	0.83a

END OF SECTION A: INSECT PESTS OF TREE FRUIT AND BERRY CROPS) PAGES 1 - 64.
REPORTS # 1 - 30.

SECTION B: **VEGETABLES AND SPECIAL CROPS / LÉGUMES ET CULTURES SPÉCIALES**

REPORT/RAPPORT #: **31 - 46**

PAGES: **65 - 104**

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2000 PMR REPORT # 31 **SECTION B:** **INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
ICAR: 30601

CROP: Cabbage, cv. Bronco
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: RELATIVE EFFICACY OF FOUR APPLICATION METHODS FOR GUTHION TO CONTROL CABBAGE MAGGOT ON CABBAGE, 2000

MATERIALS: GUTHION 50 WP (azinphos-methyl; 50% w/w a.i.)

METHODS: Cabbage seedlings cv. Bronco were grown in plug trays and then hand-transplanted at the Muck Research Station (Site 1), near Kettleby, ON, on 5 June, 2000 in 4 row plots, 5 m in length, with a row spacing of 90 cm and in-row plant spacing of 45 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Five treatments were replicated 5 times in a randomized complete block design. The same experiment was repeated at a nearby farm (Site 2) where cabbage was hand-transplanted on 26 May. The same experiment, but with a 3 m alley (E-W) and10 replications, was repeated at the Cambridge Research Station (Site 3), near Cambridge, ON, where cabbage was machine-planted (Hollandia transplanter) on 1 June. Treatment 1 consisted of GUTHION applied to plug trays three days prior to transplanting. Treatment 2 consisted of GUTHION applied to plug trays three days prior to transplanting and two weeks after transplanting. Treatment 3 consisted of GUTHION applied within an hour after transplanting and two weeks later. Treatment 4 consisted of GUTHION applied 3 days after transplanting and two weeks after transplanting. Treatment 5 was the control and consisted of the application of 200 mL of water to each plant. For plug tray treatments the rate used was 6.41 g product per 475 mL water per 128-plant plug tray (= 25 mg a.i. per plant). For transplanting and post-transplanting treatments the rate used was 5.75 g product per 10 L water per plot with 200 mL of solution poured around the base of each plant with a beaker (= 57.5 mg a.i. per plant for all field applications). At Site 1, destructive sampling of 4 plants per plot took place on 29 June and 26 July and harvest took place on 8 August. At Site 2, destructive sampling of 4 plants per plot took place on 30 June and 26 July and harvest took place on 28 July. At Site 3, destructive sampling of 4 plants per plot took place on 28 June and 25 July and harvest took place on 10 August. A post-harvest destructive sampling of 4 plants per plot took place at Site 3 on 15 August. Cabbage maggot (CM) damage was determined and rated on a scale of 0 to 4 (0 represents < 10% of root damaged; 1 represents 10-25% of root damaged; 2 represents 26-50% of root damaged; 3 represents 51-75% of root damaged; 4 represents 76-100% of root damaged). Differences in ratings between treatments were determined using analysis of variance and a Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: All four GUTHION treatments reduced CM damage relative to non-treated controls at all three sites. At Sites 1 and 2 (muck soils) reduction in CM damage among GUTHION treatments was similar and not significantly different ($P > 0.05$) from each other. At Site 3 (mineral soil) CM damage was lowest in Treatments 1 and 2 (Plug Tray and Plug Tray + 2 weeks). At Sites 1 and 2 the mean yield was greatest from Treatment 1 (Plug Tray) plots, but differences among GUTHION treatments were not significant ($P > 0.05$). At Site 3 the mean yields were greatest from Treatments 2 and 3 (Plug Tray + 2 weeks and Planting Water + 2 weeks), but differences among GUTHION treatments were not significant ($P > 0.05$). Results indicate that a single plug tray application of GUTHION provided season-long control on both muck and mineral soils. Use of this application method could reduce volume of insecticide applied by 90-95%.

Table 1. Mean damage rating of cabbage treated with GUTHION using different application methods, near Kettleby (Sites 1 and 2) and Cambridge (Site 3), ON, 2000.

Treatment No.	Rate of GUTHION 50 WP (g a.i./ plant)	Method[2]	Mean damage rating[1] for indicated date		
			Site 1		
			37070	37097	ND[3]
1	25	Plug tray	0.13 ± 0.09a[4]	0.0 ± 0.0a	-
2	25.0 + 57.5	Plug tray + 2wks	0.0 ± 0.0a	0.25 ± 0.14a	-
3	57.5 + 57.5	Planting + 2wks	0.0 ± 0.0a	0.13 ± 0.13a	-
4	57.5 + 57.5	3d after planting + 2wks	0.06 ± 0.06a	0.31 ± 0.18a	-
5	0	-	0.13 ± 0.09a	1.19 ± 0.28b	-
			Site 2		
			37071	37097	ND
1	25	Plug tray	0.19 ± 0.14a	0.25 ± 0.14a	-
2	25.0 + 57.5	Plug tray + 2wks	0.38 ± 0.15a	0.13 ± 0.09a	-
3	57.5 + 57.5	Planting + 2wks	0.13 ± 0.09a	0.31 ± 0.15a	-
4	57.5 + 57.5	3d after planting + 2wks	0.19 ± 0.14a	0.0 ± 0.0a	-
5	0	-	1.25 ± 0.27b	1.19 ± 0.23b	-
			Site 3		
			37069	37096	Aug. 15
1	25	Plug tray	0.0 ± 0.0a	0.13 ± 0.07a	0.28 ± 0.12a
2	25.0 + 57.5	Plug tray + 2wks	0.0 ± 0.0a	0.03 ± 0.03a	0.33 ± 0.13a
3	57.5 + 57.5	Planting + 2wks	0.10 ± 0.10a	0.65 ± 0.14b	0.90 ± 0.19b
4	57.5 + 57.5	3d after planting + 2wks	0.08 ± 0.06a	0.53 ± 0.14b	0.90 ± 0.17b
5	0	-	0.70 ± 0.25b	0.70 ± 0.14b	1.00 ± 0.16b

[1] 0= least, 4 = greatest degree of damage (± standard error).

[2] Plug tray = application to plug tray 3 days prior to transplanting; Plug tray + 2 wks = application to plug tray 3 days prior to transplanting and to soil 2 weeks after transplanting; Planting + 2 wks = application to soil at transplanting and 2 weeks after transplanting; 3d after planting + 2wks = application to soil 3 days after transplanting and 2 weeks after transplanting.

[3] Not determined.

[4] Values followed by the same letter, within the same column for each site, are not significantly different (P>0.05); Duncan's multiple range test.

Table 2. Mean yield of cabbage treated with GUTHION using different application methods, near Kettleby (Sites 1 and 2) and Cambridge (Site 3), ON, 2000.

Rate of GUTHION 50 WP (g a.i. per plant)	Method[1]	Mean yield (t/ha)		
		Site 1	Site 2	Site 3
25	Plug tray	14.8 ± 3.8a[2]	37.4 ± 1.3a	14.1 ± 2.1ab
25/57.5	Plug tray + 2wks	10.5 ± 2.4a	34.9 ± 0.8ab	16.2 ± 1.3b
57.5	Planting + 2wks	8.4 ± 2.2a	36.6 ± 1.0ab	16.7 ± 2.0b
57.5	3 d after planting + 2wks	12.7 ± 4.7a	36.4 ± 1.4ab	15.5 ± 2.4ab
control	–	12.3 ± 4.5a	32.9 ± 1.4b	10.0 ± 1.8a

[1] Plug tray = application to plug tray 3 days prior to transplanting; Plug tray + 2 wks = application to plug tray 3 days prior to transplanting and to soil 2 weeks after transplanting; Planting + 2 wks = application to soil at transplanting and 2 weeks after transplanting; 3 d after planting + 2wks = application to soil 3 days after transplanting and 2 weeks after transplanting.

[2] Values followed by the same letter, within the same column, are not significantly different ($P>0.05$); Duncan's multiple range test.

2000 PMR REPORT # 32 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**

ICAR: 30601

CROP: Cabbage, cv. Bronco
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: RELATIVE EFFICACY OF THREE APPLICATION METHODS FOR LORSBAN 4E OR LORSBAN 50W TO CONTROL CABBAGE MAGGOT ON CABBAGE, 2000

MATERIALS: LORSBAN 4E (chlorpyrifos; 480 g/L), LORSBAN 50W (chlorpyrifos; 50% w/w)

METHODS: Cabbage seedlings cv. Bronco were grown in plug trays and then hand-transplanted near the Muck Research Station (Site 1), near Kettleby, ON, on 26 May, 2000 in 4 row plots, 5 m in length, with a row spacing of 90 cm and in-row plant spacing of 45 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Four treatments were replicated 5 times in a randomized complete block design. The same experiment, but with a 3 m alley (E-W) and 10 replications, was repeated at the Cambridge Research Station (Site 2), near Cambridge, ON, where cabbage was machine-planted (Hollandia transplanter) on 25 May. Treatment 1 consisted of LORSBAN 4E applied to plug trays three days prior to transplanting at a rate of 2.7 mL in 475 mL water applied with a watering can (128 plants; = 10.1 mg a.i. per plant). Treatment 2 consisted of LORSBAN 50W applied within an hour after transplanting at a rate of 4.9 g in 15L of water with 200 mL poured around the base of each plant (= 32.7 mg a.i. per plant). Treatment 3 consisted of LORSBAN 4E applied 3 days after transplanting with a watering can at a rate of 8.4 mL in 5.2 L water (= 20.2 g a.i./100 m row) in an approximately 10 cm band, applied to 20 m of row. Treatment 4 was the control and consisted of the application to each plant of 200 mL of water. At Site 1, destructive sampling of 4 plants per plot took place on 30 June and 26 July and harvest took place on 28 July. At Site 2, destructive sampling of 4 plants per plot took place on 28 June and 25 July and harvest took place on 10 August. A post-harvest destructive sampling of 4 plants per plot took place at Site 2 on 15 August. Cabbage maggot (CM) damage was determined and rated on a scale of 0 to 4 (0 represents < 10% of root damaged; 1 represents 10-25% of root damaged; 2 represents 26-50% of root damaged; 3 represents 51-75% 0f root damaged; 4 represents 76-100% of root damaged). Differences in ratings between treatments were determined using analysis of variance and a Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: All three LORSBAN treatments reduced CM damage relative to non-treated controls at both sites. On the first sampling date at Site 1 (muck soil) all three LORSBAN applications were equally effective. On the second sampling date at Site 1 no LORSBAN treatment differed significantly from the control. At Site 2 (mineral soil) LORSBAN application to soil 3 days after transplanting was most effective on all three sampling dates. LORSBAN application to plug trays was of intermediate effectiveness. At Site 1 the plots treated with LORSBAN at transplanting had the greatest yield. At Site 2, while the mean yield was greatest from plots treated with LORSBAN three days after transplanting, there were no statistically significant differences among treatments (P>0.05). Results indicate that on mineral soil, a single plug tray application of LORSBAN is a viable alternative to conventional application methods that apply considerably higher amounts of pesticide. On muck soil, LORSBAN did not provide adequate season-long protection against the cabbage maggot.

Table 1. Mean damage rating of cabbage treated with LORSBAN 4E or LORSBAN 50W using different application methods, near Kettleby (Site 1) and Cambridge (Site 2), ON, 2000.

Treatment No.	Treatment	Rate	Method[2]	Mean damage rating[1] for indicated date		
				Site 1		
				36706	36732	ND[3]
1	LORSBAN 4E	10 mg a.i./ plant	Plug tray	0.05 ± 0.05a[4]	0.95 ± 0.21a	–
2	LORSBAN 50 W	32 mg a.i./ plant	Trans-planting	0.05 ± 0.05a	0.85 ± 0.22a	–
3	LORSBAN 4E	20.2 g a.i. /100 m row	3 d after transplanting	0.15 ± 0.11a	0.55 ± 0.18a	–
4	Control	–	--	0.85 ± 0.28b	1.10 ± 0.24a	–
				Site 2		
				36704	36731	36752
1	LORSBAN 4E	10 mg a.i./ plant	Plug tray	0.08 ± 0.08a	0.18 ± 0.09ab	0.50 ± 0.14ab
2	LORSBAN 50 W	32 mg a.i./ plant	Trans-planting	0.03 ± 0.03a	0.38 ± 0.13b	0.70 ± 0.17b
3	LORSBAN 4E	20.2 g a.i. /100 m row	3 d after transplanting	0.0 ± 0.0a	0.05 ± 0.03a	0.20 ± 0.10a
4	Control	–	--	0.48 ± 0.17b	0.73 ± 0.15c	1.50 ± 0.14c

[1] 0= least, 4 = greatest degree of damage (± standard error).

[2] Plug tray = application to plug tray 3 days prior to transplanting; Transplanting = application to soil immediately after transplanting; 3 d after transplanting = application to soil 3 days after transplanting.

[3] Not determined.

[4] Values followed by the same letter, within the same column for each site, are not significantly different (P>0.05); Duncan's multiple range test.

Table 2. Mean yield of cabbage treated with LORSBAN 4E or LORSBAN 50W using different application methods, near Kettleby (Site 1) and Cambridge (Site 2), Ontario, 2000.

Treatment	Method[1]	Mean yield (t/ha)	
		Site 1	Site 2
LORSBAN 4E	Plug tray	35.0 ± 1.5ab[2]	11.7 ± 2.2a
LORSBAN 50W	Transplanting	39.0 ± 1.21b	12.9 ± 2.7a
LORSBAN 4E	3 d after transplanting	32.6 ± 2.0a	16.6 ± 3.7a
Control	–	36.6 ± 0.9ab	12.2 ± 2.1a

[1] Plug tray = application to plug tray 3 days prior to transplanting; Transplanting = application to soil immediately after transplanting; 3 d after transplanting = application to soil 3 days after transplanting.

[2] Values followed by the same letter, within the same column for each site, are not significantly different at the 5% level of significance; Duncan's multiple range test.

2000 PMR REPORT # 33 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**

ICAR: 30601

CROP: Cabbage, cv. Bronco
Rutabaga, cv. Laurentian
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: SINAPIC ACID AND MONOTERPENE COMBINATIONS AS OVIPOSITION DETERRENTS AGAINST CABBAGE MAGGOT ON CABBAGE AND RUTABAGA, 2000

MATERIALS: Sinapic acid in ethanol; a plastic flexure strip containing a three-component monoterpene mix (3-carene, limonene and *p*-cymene); a plastic flexure strip containing a six-component monoterpene mix (3-carene, limonene, *p*-cymene, terpinolene, â-phellandrene, and myrcene).

METHODS: Cabbage seedlings cv. Bronco were grown in plug trays and then hand-transplanted at the Muck Research Station (Site 1), near Kettleby, ON, on 17 and 19 May in 4 row plots, 5 m in length, with a row spacing of 90 cm and in-row plant spacing of 45 cm. Plots were separated by a 1.5 m spray lane (N-S) and a 1.5 m alley (E-W). Six treatments were replicated 5 times in a randomized complete block design. The same experiment was repeated with rutabaga cv. Laurentian at the Cambridge Research Station, near Cambridge, ON (Site 2) where rutabaga was machine-seeded with a Stanhay precision seeder on 8 May. Part of the field was subsequently tilled leaving plants which were arranged in 4 row plots, 5 m in length, with a row spacing of 90 cm. Plots were separated by a 3 m spray lane (N-S) and a 3 m alley (E-W). The rutabaga plants were thinned to a plant spacing of 15 cm one month after seeding. Treatments were applied on 31 May at Site 1 and 17 July at Site 2. Treatment 1 consisted of 0.05% sinapic acid sprayed at a rate of 6.67 g/100 m of row. Five g sinapic acid was dissolved in 200 mL ethanol, 9 L buffer and 2 mL Tween 20. This mixture was applied with a backpack sprayer with a fan nozzle (#8006) at a pressure of 250 kPa. Treatment 2 consisted of placing a 5 cm length of a 3-component monoterpene plastic flexure next to each plant. Treatment 3 consisted of placing a 5 cm length of a 6-component monoterpene plastic flexure next to each plant. Treatment 4 consisted of placing a 5 cm length of a 3-component monoterpene plastic flexure next to each plant plus the sinapic acid mixture from Treatment 1. Treatment 5 consisted of placing a 5 cm length of a 6-component monoterpene plastic flexure next to each plant plus the sinapic acid mixture from Treatment 1. Treatment 6 consisted of non-treated control plots. Treatments 2, 3 and 6 were also treated with the same mixuture from Treatment 1, not including the sinapic acid, to expose all plots to the ethanol/buffer/Tween 20 solvent mixture. Egg counts commenced on 1 June at Site 1 and continued for a total of fourteen consecutive days. Egg counts were performed randomly on four plants per plot (middle two rows, two per row) around plant stems and surrounding soil (within 1 cm of stem). Egg counts commenced on 18 July at Site 2 and continued for a total of fourteen consecutive days. Destructive sampling of 4 cabbage plants per plot was performed at Site 1 on 29 June and 26 July. CM damage on cabbage was rated on a scale of 0 to 4 (0 represents < 10% of root damaged; 1 represents 10-25% of root damaged; 2 represents 26-50% of root damaged; 3 represents 51-75% of root damaged; 4 represents 76-

100% of root damaged). Destructive sampling of 4 rutabaga plants per plot was performed at Site 2 on 17 July and 23 August. CM damage on rutabaga was rated (King, K.M. and A.R. Forbes. 1954. J. Econ. Entomol. 47: 607-615) on a scale of 0 to 3 (0-clean; 1-light; 2-moderate; 3-severe injury). Cabbage was harvested on 28 July and yield (t/ha) was determined. Rutabaga was harvested on 23 August and yield (t/ha) was determined. Differences in egg numbers, CM damage and yield among treatments were determined using analysis of variance and a Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: While the fewest mean number of eggs was deposited on cabbage plants treated with the 6-component monoterpene + sinapic acid combination (Treatment 5), this difference was not statistically different from other treatments or the control. On rutabaga the mean numbers of eggs counted for each treatment group were not significantly different (P>0.05). Mean CM damage on cabbage was lowest in the 6-component monoterpene + sinapic acid combination treatment group on the first sampling date. None of the monoterpene + sinapic acid combinations significantly reduced (P>0.05) CM damage on rutabaga. Use of sinapic acid and/or monoterpenes does not seem a very promising method of reducing CM damage. The different treatments had no significant impact on mean yields of either cabbage (Table 1) or rutabaga (Table 2) (P>0.05).

Table 1. Mean number of cabbage maggot eggs per day, mean cabbage maggot (CM) damage and mean yield of cabbage plants treated with various sinapic acid and monoterpene combinations at Kettleby, ON, 2000.

Treatment No.	Treatment	Mean number of eggs[1]	Mean CM damage		Mean yield (t/ha)
			36705	36732	
1	Sinapic acid	0.25 ± 0.93a[2]	0.75 ± 0.25a	1.35 ± 0.22a	29.7 ± 4.0a
2	3-CM[3]	0.35 ± 1.32a	0.45 ± 0.17ab	0.60 ± 0.24a	32.9 ± 3.1a
3	6-CM[4]	0.29 ± 0.98a	0.75 ± 0.24a	1.00 ± 0.24a	33.5 ± 2.8a
4	3-CM + Sinapic acid	0.24 ± 0.84a	0.40 ± 0.17ab	1.2 ± 0.28a	33.7 ± 3.0a
5	6-CM + Sinapic acid	0.20 ± 0.71a	0b	0.65 ± 0.21a	33.9 ± 4.6a
6	Control	0.42 ± 1.95a	0.45 ± 0.20ab	0.65 ± 0.23a	32.6 ± 1.7a

[1] Mean eggs per day over the fourteen day observation period.

[2] Values followed by the same letter, in the same column, are not significantly different (P>0.05); Duncan's multiple range test.

[3] Three-component monoterpene

[4] Six-component monoterpene

Table 2. Mean number of cabbage maggot eggs present, mean cabbage maggot (CM) damage and mean yield from rutabaga plants treated with various sinapic acid and monoterpene combinations at Cambridge, ON, 2000.

Treatment No.	Treatment	Mean number of eggs	Mean CM damage		Mean yield[1] (t/ha)
			17 July (pre-treatment)	36760	
1	Sinapic acid	0.63 ± 0.07a[2]	1.50 ± 0.21a	0.78 ± 0.11ab	4.7 ± 1.0a
2	3-CM[3]	0.67 ± 0.07a	1.30 ± 0.23a	0.84 ± 0.12ab	4.1 ± 1.0a
3	6-CM[4]	0.64 ± 0.07a	0.75 ± 0.16a	0.60 ± 0.12b	2.7 ± 0.5a
4	3-CM + Sinapic acid	0.52 ± 0.05a	1.05 ± 0.18a	0.70 ± 0.13ab	4.5 ± 0.8a
5	6-CM + Sinapic acid	0.67 ± 0.07a	0.95 ± 0.21a	1.06 ± 0.13a	4.2 ± 0.6a
6	Control	0.66 ± 0.08a	0.85 ± 0.21a	0.90 ± 0.15ab	2.3 ± 0.6a

[1] Marketable yield (included only roots in 10-15 cm size class).

[2] Values followed by the same letter, in the same column, are not significantly different (P>0.05); Duncan's multiple range test.

[3] Three-component monoterpene.

[4] Six-component monoterpene.

2000 PMR REPORT # 34 **SECTION B: INSECT PESTS OF VEGETABLE and SPECIAL CROPS** **ICAR: 206003**

CROP: White Cabbage cv. Bronco
PEST: Imported Cabbageworm (ICW), *Artogeia (=Pieris) rapae*
Cabbage Looper (CL), *Trichoplusia ni*
Diamondback Moth (DBM), *Plutella xylostella*

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TITLE: EVALUATION OF CONTROL AGENTS FOR THE CONTROL OF IMPORTED CABBAGEWORM, CABBAGE LOOPER AND DIAMONDBACK MOTH IN CABBAGE, 2000

MATERIALS: BIOPROTEC (Bacillus thuringiensis), DIPEL 2XDF (Bacillus thuringiensis), AGRAL 90 (90% nonphenoxy polyethoxy ethanol)

METHODS: The cabbage was grown from transplants which were seeded into 128 plug trays on 23 May. The trial was transplanted into the field on 29 June at the Muck Crops Research Station where ICW, CL and DBM naturally occur. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of four rows (86 cm apart), 5 meters in length. Scouting of the trial commenced 8 days after transplanting. Each treatment was scouted separately and the number and species of caterpillars was recorded. A spray threshold was determined using the Caterpillar Looper Equivalent (CLE) method found in the Integrated Pest Management for Crucifers in Ontario Handbook. Once the entire trial reached the threshold of 0.3 the trial was sprayed. All treatments were applied using a pull type plot sprayer with D-2 hollow cone nozzles in 500 L/ha of water at 690 kPa (boom). Four days after the treatments were applied the entire trial was scouted and the number and species of insects was recorded. After the initial scouting after spraying, only the BIOPROTEC treatments with AGRAL 90 were scouted to determine the next spray threshold. A total of two sprays were applied on 25 July and 3 August. Samples for yield and final insect damage were taken on 19 September. The air temperatures were above the long term (10 year) average for May (13.6°C), below average for June (17.5°C), July (18.7°C) and August (18.7°C) and average for September (14.5°C). Total rainfall was above the long term (10 year) average for May (160.3 mm), June (173.4 mm), and August (75.7 mm), below average for September (79.8 mm) and average for July (86.4). Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1

RESULTS: As presented in Table 1.

CONCLUSIONS: On 3 Aug, 8 days after the first treatment, CLE's were significantly lower in the plots treated with BIOPROTEC at 2.8 L/ha and BIOPROTEC at 2.8 L/ha + AGRAL 90 at 1.0 L/ha than in the untreated plots or in plots treated with the commercial standard, DIPEL. The low rate of BIOPROTEC also had low CLE's at the final assessment, however not significantly. No significant differences were observed in yield.

Table 1: Impact of control agents on Lepidoptera pests of cabbage, 2000.

Treatment	Rate L/ha	CLE for Indicated Date			% Marketable	Yield (kg)
		July 25	37105	Sept 19		
Check	-	1.30 a *	1.03 c	3.43 a	62.5 a	43.7 a
BIOPROTEC	1.4	0.38 a	0.15 ab	0.73 a	87.5 a	41.8 a
BIOPROTEC	2.8	1.13 a	0.05 a	1.35 a	62.5 a	40.3 a
BIOPROTEC + AGRAL 90	1.4 + 1.0	1.43 a	0.20 ab	2.63 a	75.0 a	39.2 a
BIOPROTEC + AGRAL 90	2.8 + 1.0	1.95 a	0.00 a	2.05 a	72.5 a	40.1 a
DIPEL	250 g/ha	0.53 a	0.75 bc	3.08 a	85.0 a	40.6 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's protected LSD Test.

2000 PMR REPORT # 35 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9304

CROP: Cabbage, cv. Blue Vantage
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: EVALUATION OF PLANTING TREATMENTS FOR CONTROL OF DAMAGE BY CABBAGE MAGGOT TO CABBAGE IN MINERAL SOIL, 2000

MATERIALS: ACTARA 25 WG (thiamethoxam), BOTANIGARD (*Beauveria bassiana*)(2.1 x 10^{13} viable spores/L), CANON 200 SC (fipronil), LORSBAN 4 E (chlorpyrifos), SNIPER 50 WP (azinphosmethyl)

METHODS: Cabbage transplants were grown singly in plastic propagation-plug trays each containing 12 rows of 24 plugs. Seedlings were grown to the 4-5 leaf stage in a commercial greenhouse near Wilsonville, ON. On May 16, 3 hrs prior to planting, tray drench (TD) treatments (Tmts. 1, 4, Table 1) were applied at 250 kPa in 2.0 ml/plant using a hand-held, single-nozzled (6506EVS flat fan), CO_2-pressurized, R&D plot sprayer. Plants were immediately flushed with 4.0 ml water/plant to rinse the insecticide from the foliage and down into the planting medium of individual plugs. Seedlings were transplanted into 1-row microplots (2.25 m long x 0.9 m wide), filled with insecticide-residue-free mineral soil, on the London Research Farm of the Southern Crop Protection and Food Research Centre. Each row contained 15 transplants. All treatments received 100 ml starter fertilizer (soluble 10-52-10 [N-P-K] at 2.5 g/L) in the planting hole; insecticide for the planting water (PW)(Tmt. 2, 3, 5-11, Table 1) was added to the starter fertilizer. All treatments were replicated three times in a randomized complete block design. On June 1, 10-15 CM eggs from an insecticide-susceptible, laboratory strain, originally collected near Chatham, ON, were buried 1 cm deep beside each plant. To improve egg hatch and maggot survival, plots were watered after infestation. On June 29, infested plants were carefully dug, roots washed and rated for CM feeding damage (0 - no feeding damage; 1 - small feeding channels on root/stem comprising < 5% surface area; 2 - 6%-25% surface area affected by feeding; 3 - 26%-50% surface area affected by feeding; 4 - 51%-75% surface area affected by feeding; 5 -76%-100% surface area affected by feeding, plant dying or dead. If feeding extended down into cortex of root, damage rating was increased by 1). Numbers of plants with ratings of 0 or 1, and with ratings of 3, 4 or 5, were summed, percentage of total infested plants calculated and data subjected to arcsin square root transformation prior to statistical analysis by analysis of variance. Significance of differences among treatments means was determined using a Least Significant Difference Test. Untransformed data are presented.

RESULTS/OBSERVATIONS: CM-feeding damage to cabbage roots following insecticide application as planting treatments is shown in Table 1 below. TD-application of CANON (Tmt. 4) provided virtually complete protection of cabbage roots; all roots showed less than 5% damage from CM hatching from introduced eggs. PW-application of CANON alone (Tmt. 5), LORSBAN alone (Tmt. 10), SNIPER alone

(Tmt. 11) and either CANON (Tmt. 7) or LORSBAN (Tmt. 9) in combination with BOTANIGARD also provided excellent protection of cabbage roots. Neither PW-application of BOTANIGARD alone (Tmt. 6) nor either rate of ACTARA alone (Tmts. 1, 2) significantly increased root-protection. Combination of ACTARA with BOTANIGARD in PW did, however, significantly increase root-protection as indicated by an increase in the % of lightly damaged roots. Those treatments that significantly increased root protection also significantly reduced the % of cabbage roots with severe damage (> 26% of root damaged by feeding scars).

Cabbage seedlings were severely damaged by application of LORSBAN in the planting water, either alone (Tmt. 10) or in combination with BOTANIGARD (Tmt. 9). No phytotoxicity was observed following application of any other treatment.

CONCLUSIONS: TD- or PW-application of CANON protected cabbage roots from CM hatching from introduced eggs as effectively as currently recommended PW-application of SNIPER. Combination of BOTANIGARD with ACTARA in PW significantly improved root protection over protection provided by either alone. Emulsifiable-concentrate formulations of chlorpyrifos should not be applied to cabbage in planting water.

Table 1. Effect of planting treatments on damage to cabbage roots by cabbage maggot, London, ON, 2000.

Tmt. No.	Treatment Applied	Rate Applied (pdct)	Method[1]	Mean % Roots in Indicated Category	
				Rating 0-1	Rating 3-5
1.	ACTARA 25WG	32.0 g	TD	44.4 bc[2]	45.2 a
2.	ACTARA 25WG	24.0 g	PW	50.0 b	40.0 a
3.	ACTARA 25WG	32.0 g	PW	43.3 bc	36.7 a
4.	CANON 200SC	30.0 ml	TD	100.0 a	0.0 b
5.	CANON 200SC	40.0 ml	PW	86.7 a	3.3 b
6.	BOTANIGARD	250.0 ml	PW	36.7 bc	56.7 a
7.	CANON 200SC + BOTANIGARD	30.0 ml + 250.0 ml	PW	93.3 a	0.0 b
8.	ACTARA 25WG + BOTANIGARD	32.0 g + 250.0 ml	PW	90.0 a	3.3 b
9.	LORSBAN 4E + BOTANIGARD	83.3 ml + 250.0 ml	PW	93.3 a	0.0 b
10.	LORSBAN 4E	83.3 ml	PW	86.7 a	6.7 b
11.	SNIPER 50WP	200.0 g	PW	94.4 a	0.0 b
12.	CONTROL[3]	---	---	13.3 c	63.3 a

[1] Method of Application: TD - tray-drench; PW - planting water.

[2] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined by a Least Significant Difference Test.

[3] no insecticide.

2000 PMR REPORT # 36 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**

ICAR: 30601

CROP: Celery, cv. Florida 683
PEST: Pea Leafminer (PLM), *Liriomyza huidobrensis* (Blanchard)

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TITLE: EFFICACY OF CITATION, AN INSECT GROWTH REGULATOR, AND PARATHION FOR CONTROL OF PEA LEAFMINER ON CELERY, 2000

MATERIALS: CITATION 75WP (cyromazine 75% w/w) and PARATHION 960 EC

METHODS: Celery seedlings cv. Florida 683 were grown in plug trays and then hand-transplanted at the Muck Research Station near Kettleby, ON, on 13 July, 2000 in 6 row plots, 5 m in length, with a row spacing of 55 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Four treatments were replicated 5 times in a randomized complete block design. Treatment 1 was the control. Treatment 2 consisted of PARATHION applied at a rate of 288 g a.i. per ha on 26 July and 31 August. Treatment 3 consisted of CITATION applied at a rate of 70 g a.i. per ha on 26 July and 3, 17 and 31 August. Treatment 4 consisted of CITATION applied at a rate of 140 g a.i. per ha on 26 July and 3, 17, 21, and 31 August. All treatments were applied with a pull type plot sprayer with TeeJet D-2 hollow cone nozzles at 690 kPa (boom) in 500 L/ha water. Plots were monitored for leaf mining (caused by larvae) and stippling (caused by ovipositing adults) twice per week. Both sides of two leaves per plant on five randomly chosen plants per plot were examined. PLM mining damage was rated on a scale of 0 to 4 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk; 4 = mines present on stalk). PLM stippling damage was determined and rated on a scale of 0 to 2 (0 = no stipples; 1 = 1-10 stipples; 2 = >10 stipples per leaf). Season mean damage was calculated from all damage data collected after the first spraying (after 26 July). Celery was harvested on 31 September. Ten plants from each plot were weighed and graded according to damage. The total weight of all 10 plants was recorded before and after trimming. The trimmed weight of each plant was determined and rated on a scale of 0 to 2 (0 = < 0.80 kg; 1 = 0.80-0.99 kg; 2 = ≥1.0 kg). Mining damage was determined before and after trimming and rated on a scale of 0 to 4 (0 = all stalks undamaged; 1 = 1-25% of stalks damaged; 2 = 26-50% of stalks damaged; 3 = 51-75% of stalks damaged; 4 = 75-100% of stalks damaged). Differences in ratings and weights among treatments were determined using analysis of variance and a Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: Mining damage was most reduced for the higher CITATION rate (Treatment 4) and this was significantly different from damage on PARATHION plots but not significantly different from the other two treatments (Table 1). Stippling damage was most reduced for the higher CITATION rate and this was significantly different from the other treatments. Mean weight per plant was greatest in the higher CITATION rate but these differences were not significant (Table 2). At harvest, mining damage was the least in the two CITATION treatment groups and these differences were significant.

Table 1. Season mean pea leafminer mining and stippling damage on celery treated with CITATION 75WP and PARATHION 960 EC, near Kettleby, ON, 2000.

Treatment No.	Insecticide	Rate	Rating for Indicated Damage	
			mining[1]	stippling[2]
1	none	–	1.46 ± 0.05ab[3]	1.86 ± 0.02a
2	PARATHION	288 g a.i. per ha	1.48 ± 0.05a	1.92 ± 0.02b
3	CITATION	70 g a.i. per ha	1.39 ± 0.05ab	1.86 ± 0.02a
4	CITATION	140 a.i. per ha	1.33 ± 0.05b	1.80 ± 0.02c

[1] 0= least, 4 = greatest degree of damage (± standard error).

[2] 0= least, 2 = greatest degree of damage (± standard error).

[3] Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.

Table 2. Mean weight per plant and pea leafminer damage of celery treated with CITATION 75 WP and PARATHION 960 EC, near Kettleby, ON, 2000.

Treat No.	Insecticide and Rate	Pre-trimming		Post-trimming		
		Wt/plant (kg)	Damage[1]	Wt/plant (kg)	Wt. Class[2]	Damage
1	none	0.85 ± 0.06a[3]	2.48 ± 0.09a	0.55 ± 0.03a	0.02 ± 0.02a	2.46 ± 0.08a
2	PARATHION 288 g a.i./ ha	0.82 ± 0.06a	2.58 ± 0.08a	0.56 ± 0.04a	0.14 ± 0.06a	2.50 ± 0.09a
3	CITATION 70 g a.i./ ha	0.93 ± 0.06a	2.10 ± 0.10b	0.61 ± 0.03a	0.10 ± 0.04a	1.88 ± 0.10b
4	CITATION 140 a.i./ ha	0.95 ± 0.09a	2.04 ± 0.11b	0.62 ± 0.05a	0.16 ± 0.05a	1.76 ± 0.10b

[1] Rated on a scale of 0 to 4 (0 = all stalks undamaged; 1 = 1-25% of stalks damaged; 2 = 26-50% of stalks damaged; 3 = 51-75% of stalks damaged; 4 = 75-100% of stalks damaged).

[2] Rated on a scale of 0 to 2 (0 = < 0.80 kg; 1 = 0.80-0.99 kg; 2 = ≥ 1.0 kg).

[3] Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.

2000 PMR REPORT # 37 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIALTY CROPS**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Cortland
PEST: Onion maggot (OM), (*Delia antiqua* Meigen)

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TITLE: EVALUATION OF INSECTICIDE AND FUNGICIDE TREATMENT COMBINATIONS FOR THE CONTROL OF ONION MAGGOT: FIELD TRIAL IN THE HOLLAND MARSH, 2000.

MATERIALS: LORSBAN 15G (chlorpyrifos 15%), GOVERNOR 75WP (cyromazine 75%), AZTEC 2.1G (tebupirimfos 2.0% + cyfluthrin 0.1%), REGENT 80WG (fipronil 80%), PRO GRO D (carbathiin 30% + thiram 50%), DITHANE DG (mancozeb 75%)

METHODS: The trial was conducted at the University of Guelph Muck Crops Research Station located in the Holland Marsh, ON with natural populations of onion flies. It was arranged in a randomized complete block design with a total of 20 treatments and four replications. GOVERNOR 75WP, REGENT 80WG and PRO GRO 30/50D seed treatments were film-coated at rates of 50, 25 and 20 g ai/kg of seed respectively by Alan Taylor in Cornell, NY. LORSBAN 15G (4.8 kg ai/ha), AZTEC 2/0.1G (0.5 kg ai/ha) and DITHANE DG 75G (6.6 kg ai/ha) were applied in-furrow with the seed. The trial was seeded at a rate of 40 seeds/m of row on 5 May, using a push V-belt seeder. Each treatment plot consisted of four 6 m rows of onions spaced 40 cm apart. Four separate 2 m sections were randomly selected in each plot for each of three OM damage assessments and final yield. To determine initial stand, emergence counts were taken on 17, 24, 26, 30 May and 8 Jun in each 2 m section. OM damage was assessed at the end of each the first- (13 Jul), second- (19 Aug) and third- (21 Sep) generations as determined by monitoring onion fly trap catches and degree days. All onions in the 2 m sections of row were pulled and visually examined for maggot damage. Twice weekly from 20 Jun to 8 Aug, dying onions were pulled and cause of death (OM, onion smut or other) was recorded. For yield assessment (21 Sep), weight and bulb size were taken from the remaining 2 m section of onions. Data was analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1. Interaction between insecticides (none, LORSBAN, GOVERNOR, AZTEC, REGENT) and fungicides (none, PRO GRO, DITHANE DG, PRO GRO+DITHANE DG) was analyzed using a 5 x 4 factorial design.

RESULTS: No significant interaction between insecticides and fungicides was found at any assessment (Table 1). Significant main effects showed that treatments with REGENT had the least OM damage, followed in order by those with GOVERNOR, AZTEC and then LORSBAN. Significant differences were found among treatments for OM damage at all assessments (Table 2), but not for final yield (data not shown). All treatments with REGENT significantly reduced OM damage in comparison to the untreated check in all assessments, except when it was used by itself in the third assessment. Otherwise, there were no consistent significant differences or trends among insecticides across assessments or with fungicide combinations. Although not significant, best control of OM was achieved when insecticides were used in combination with PRO GRO + DITHANE DG. DITHANE DG + REGENT proved the most effective of all 20 treatments in all assessments. The air temperatures were above the long term (10 year) average for May, below average for June, July and August and average for September. Total rainfall was above the long term average for May (160.3 mm), June (173.4 mm), and August (75.7 mm), below average for September (79.8 mm) and average for July (86.4mm).

CONCLUSIONS: REGENT, as a film-coat, was the only insecticide that consistently provided effective season-long control of OM. It was most effective in combination with DITHANE DG (92.5-100% control), followed by PRO GRO + DITHANE DG (90.8-93% control) and then PRO GRO (58.9-100% control). When it was used alone control ranged from 91.5% for the first generation to 18.3% by the end of the third generation.

Table 1. Main effects and interactions of fungicides and insecticides for the control of onion smut.

	Onion Maggot Damage (%)		
Insecticide	1st gen (13 Jul)	1st & 2nd gen (19 Aug)	1st, 2nd & 3rd gen (21 Sep)
untreated	23.3 a	26.3 a	36.3 a
LORSBAN	13.2 b	18.7 ab	26.3 ab
GOVERNOR	5.4 bc	16.1 b	23.9 bc
AZTEC	11.0 b	20.7 ab	33.9 ab
REGENT	1.2 c	5.14 c	14.5 c
p value F	0.0001	0.0003	0.0015
Fungicide			
untreated	13.3	21.8	40.6 a
PRO GRO	8.9	19.3	28.9 b
DITHANE DG	13.4	16.3	20.3 bc
PRO GRO + DITHANE DG	7.7	12.2	18.2 c
p value I	0.3298	0.0997	0.0001
I*F p value	0.9202	0.5819	0.4823

Table 2. Effectiveness of insecticides (LORSBAN, GOVERNOR, AZTEC and REGENT) in combination with fungicides (PRO GRO, DITHANE DG, PRO GRO + DITHANE DG) for OM control at the Muck Crops Research Station, Kettleby, Ontario, in 1999.

Treatment	Rate Applied	Onion Maggot Damage (%)		
		1st gen (13 Jul)	1st & 2nd gen (19 Aug)	1st, 2nd & 3rd gen (21 Sep)
untreated		26.1 a[2]	30.0 a	41.6 ab
PG[1]	20 g ai/kg[3]	21.8 a-e	20.2 a-d	34.1 a-c
DG	6.6 kg ai/ha	22.2 a-d	27.1 a-c	39.6 a-c
PG+DG	20 g ai/kg + 6.6 kg ai/ha	23.0 a-c	28.1 ab	29.8 a-e
L	4.8 kg ai/ha	11.4 a-f	21.0 a-d	35.7 a-c
PG+L	20 g ai/kg + 4.8 kg ai/ha	11.4 a-f	25.0 a-c	30.5 a-d
DG+L	6.6 kg ai/ha + 4.8 kg ai/ha	24.6 ab	18.7 a-e	27.5 a-f
PG+DG+L	20 g ai/kg + 6.6 kg ai/ha + 4.8 kg ai/ha	5.6 d-f	9.9 c-e	11.7 e-h
G	50 g ai/kg	12.1 a-f	23.7 a-c	48.1 a
PG+G	20 g ai/kg + 50 g ai/kg	2.9 e	12.0 b-e	24.3 c-f
DG+G	6.6 kg ai/ha + 50 g ai/kg	4.6 ef	17.6 a-e	11.6 f-h
PG+DG+G	20 g ai/kg + 6.6 kg ai/ha + 50 g ai/kg	1.8 e	11.2 b-e	11.5 d-h
A	0.5 kg ai/ha	14.7 a-f	22.5 a-d	43.3 ab
PG+A	20 g ai/kg + 0.5 kg ai/ha	8.1 b-f	33.9 a	38.4 a-c
DG+A	6.6 kg ai/ha + 0.5 kg ai/ha	15.5 a-f	16.6 a-e	19.8 b-f
PG+DG+A	20 g ai/kg + 6.6 kg ai/ha + 0.5 kg ai/ha	5.7 c-f	9.6 c-e	34.2 a-c
R	25 g ai/kg	2.2 e	11.7 b-e	34.0 a-c
PG+R	20 g ai/kg + 25 g ai/ha	0.0 e	5.4 de	17.1 c-g
DG+R	6.6 kg ai/ha + 25 g ai/kg	0.0 e	1.4 e	3.1 h
PG+DG+R	20 g ai/kg + 6.6 kg ai/ha + 25 g ai/kg	2.4 e	2.1 e	3.6 gh

[1] **L**: LORSBAN, **G**: GOVERNOR, **A**: AZTEC, **R**: REGENT, **PG**: PRO GRO, **DG**:DITHANE DG

[2] Numbers in a column followed by the same letter are not significantly different at p=0.05, Fisher's Protected LSD test.

[3] Seed treatment: g ai/kg of seed for GOVERNOR, REGENT and PRO GRO.

2000 PMR REPORT # 38 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9904

CROP: Spanish onion, cv. Yula
PEST: Onion thrips (OT). *Thrips tabaci* Lindeman

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TITLE: EVALUATION OF PLANTING-WATER TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING SPANISH ONION ON MINERAL SOIL, 2000

MATERIALS: ADMIRE 240 F (imidacloprid), ACTARA 25 WG, (thiamethoxam), EXP 61486A 70 WP (acetamiprid), ORTHENE 75 SP (acephate), CaB'y (10% Ca, 0.5% B solution)

METHODS: Commercially produced Spanish onion seedlings were grown singly in plastic propagation-plug trays each containing 12 rows of 24 plugs. On May 09, just prior to planting, seedlings were clipped to a height of 10-12 cm. All treatments (64 plants/plot) were planted on the SCPFRC-London Research Farm in 4-row microplots (2.25 m long x 0.9 m wide) filled with insecticide-residue-free mineral soil. All treatments were replicated 3 times in a randomized complete block design. All treatments received 30 ml transplant-water in the planting hole; the desired rate of insecticide was added to the transplant-water. Individual seedlings were established in planting holes as soon as possible after adding transplant-water. On June 12, 22, July 04, 18, and 28, CaB'y was applied at 2.5 L/ha in 900 L/ha, at 200 kPa, using a hand-held, CO_2 pressurized R&D field-plot sprayer fitted with a 0.45 m boom equipped with two XR8002VS flat fan spray nozzles. On June 12, 19, 26, July 4 ,10, 17, 24 and 31, OT were counted by destructive sampling. With the exception of June 12 and 19 (2 plants/plot), 3 plants were randomly selected from each plot on each date. On each date, statistical significance of observed impact of planting-water treatments on OT numbers was determined by analysis of variance. Significance of observed differences among treatment means was determined using Fishers Protected Least Significant Difference test.

RESULTS: Experimental results are outlined in Table 1. No phytotoxicity was observed following any planting-water treatment. OT numbers did not increase to high levels during the generally cool, wet weather experienced at SCPFRC-London during the growing season. Not until July 17, 10 weeks after planting did OT populations on untreated onions exceed the OMAFRA-recommended threshold of 1.0 OT/leaf for Spanish onions. On that date, OT populations were significantly lower on Spanish onions treated at planting with the higher rate of ACTARA (Tmt. 2) or any rate of ADMIRE (Tmts. 4-6) than on onions that had received no insecticide at planting and that had not received subsequent foliar application of CaB'y. By July 31, 12 weeks after treatment, no planting-water treatment had any significant impact on OT numbers. Although the difference was statistically significant only on July 17, by July 04, 8 days after the second foliar application of CaB'y, OT numbers usually tended to be higher on onions that were not treated with foliar calcium.

CONCLUSIONS: Planting-water application of a systemic insecticide such as ACTARA or ADMIRE to Spanish onion seedlings had sufficient impact on subsequent development of OT populations to warrant further investigation.

Table 1: Impact of planting-water treatments on populations of onion thrips on Spanish onion transplants, 2000.

Tmt. No.	Treatment Applied	Rate/1,000 Plants	Mean Number OT/Plant on Indicated Date							
			12 Jun	19 Jun	26 Jun	04 Jul	10 Jul	17 Jul	24 Jul	31 Jul
1.	ACTARA	4.0 g	0.0 c[1]	2.0 c	2.0 abc	5.6 a	11.9 a	16.8 ab	8.6 cde	5.5 a
2.	ACTARA	6.0 g	0.7 bc	1.8 c	1.0 bc	4.9 a	8.2 abc	7.3 bc	12.8 bcd	11.2 a
3.	ACTARA + CaB'y[2]	4.0 g	0.0 c	2.9 abc	3.5 a	6.1 a	4.3 cde	15.9 ab	15.2 abc	8.5 a
4.	ADMIRE	6.0 ml	0.0 c	0.3 c	2.2 abc	3.9 a	2.4 de	5.1 bc	6.2 cde	6.4 a
5.	ADMIRE	12.0 ml	0.0 c	0.2 c	0.6 c	2.4 a	1.6 de	4.1 c	3.8 de	4.6 a
6.	ADMIRE + CaB'y[2]	6.0 ml	0.0 c	0.6 c	0.8 bc	3.6 a	2.6 de	9.8 bc	11.0 bcde	4.8 a
7.	EXP 61486A	3.0 g	2.0 abc	2.5 bc	2.8 ab	8.1 a	10.2 ab	16.7 ab	8.7 cde	16.4 a
8.	ORTHENE	70.0 g	0.5 bc	1.8 c	2.1 abc	3.6 a	6.1 bcd	12.8 bc	11.0 bcde	15.5 a
9.	CONTROL[4]	---	2.8 abc	5.8 ab	3.5 a	7.7 a	8.4 abc	26.6 a	20.5 ab	21.2 a
10.	CaB'y[2]	---	4.3 a	6.5 a	3.3 a	4.2 a	6.1 bcd	9.7 bc	24.5 a	10.1 a
Mean Number Leaves/Plant			xxx[5]	7	8	9	10	11	12	12
Mean Number OT/Leaf[3]				0.9	0.4	0.7	0.7	1.7	1.9	1.3

[1] - Means within a column followed by the same letter are not significantly different ($P \le 0.05$) as determined using Fishers Protected Least Significant Difference test.

[2] 2.5 L/ha.

[3] calculated by dividing the mean number OT/plant in untreated plots for each date by the mean number of leaves/plant on that date.

[4] no insecticide.

[5] no record of number of leaves/plant.

2000 PMR REPORT # 39 **SECTION B: INSECT PESTS OF VEGETABLES AND SPECIAL CROPS**
ICAR: 30601

CROP: Spinach, cv. Unipack 151
PEST: Pea Leafminer (PLM), *Liriomyza huidobrensis* (Blanchard)

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TITLE: EFFICACY OF CITATION, AN INSECT GROWTH REGULATOR, AND PARATHION FOR CONTROL OF PEA LEAFMINER DAMAGE ON SPINACH, 2000

MATERIALS: CITATION 75WP (cyromazine 75%), PARATHION 960 EC (parathion)

METHODS: Spinach cv. Unipack 151 was machine-seeded at the Muck Research Station near Kettleby, ON, on 21 July, 2000 in 8 row plots, 5 m in length, with a row spacing of 40 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Four treatments were replicated 5 times in a randomized complete block design. Spray treatments were applied on 17 August, 2000. All treatments were applied with a pull type plot sprayer with TeeJet D-2 hollow cone nozzles at 690 kPa (boom) in 500 L/ha water. Spinach was harvested on 28 and 30 August (2 or 3 reps per treatment were harvested on each date). Twenty plants from each plot were rated (7 leaves per plant) according to mining damage on a scale of 0- 2 (0 = no mines, 1 = 1 - 5 mines and 2 = >5 mines). One hundred harvested plants from each plot were weighed. Differences in damage ratings and weights among treatments were determined using analysis of variance and a Duncan's multiple range test.

RESULTS: The results are summarized in Table 1. Significantly less mining damage was recorded in plots treated with either rate of CITATION (Tmt. 2, 3) than in plots treated with PARATHION (Tmt. 4). Application of PARATHION did not significantly reduce the amount of mining below levels recorded in CONTROL plots (Tmt. 1). Although the highest 100 plant-weight was recorded for spinach harvested from plots treated with the lower rate of CITATION, the observed weight differences among treatments were not statistically significant.

CONCLUSIONS: Based on the results of this trial, application of the growth regulator CITATION is a promising method for control of PLM-mining in spinach.

Table 1. Effect of CITATION 75WP and PARATHION 960 EC on pea leafminer-mining damage and weight per 100 spinach plants, near Kettleby, ON, 2000.

Treatment No.	Treatment Applied	Rate (a.i./ha)	Mean mining damage[1] (mines per leaf)	Mean weight per 100 plants (kg)
1	Control[2]	–	1.69 ± 0.03 ab[3]	6.55 ± 0.85 a
2	CITATION	70.0 g	1.60 ± 0.03 c	6.82 ± 1.14 a
3	CITATION	140.0 g	1.61 ± 0.03 bc	4.91 ± 0.90 a
4	PARATHION	288.0 g	1.71 ± 0.02 a	5.15 ± 0.84 a

[1] Rated on a scale of 0 - 2 (0 = no mines, 1 = 1 - 5 mines and 2 = >5 mines).

[2] No insecticide.

[3] Values followed by the same letter, within the same column, are not significantly different ($P>0.05$); Duncan's multiple range test.

2000 RAPPORT RLD # 40 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
IRAC: 22221530

CULTURE: Maïs sucré, cv. Quickie
RAVAGEUR: Pyrale du maïs, *Ostrinia nubilalis*

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TITRE: ESSAI D'UN NOMBRE RÉDUIT DE TRAITEMENTS INSECTICIDES CONTRE LA PREMIÈRE GÉNÉRATION DE LA RACE BIVOLTINE DE LA PYRALE DU MAÏS SUR LE MAÏS SUCRÉ HÂTIF

PRODUITS: MATADOR 50EC (lambda-cyhalothrine); FURADAN 480F (carbofuran)

MÉTHODES: L'essai a été réalisé à Saint-Hyacinthe (Québec) selon un dispositif expérimental en blocs complets aléatoires répétés 5 fois. Le maïs a été semé le 29 avril 2000. Les parcelles de 10 m de longueur comprenaient 8 rangs espacés de 76 cm. Les produits utilisés ont été les suivants: traitements 1 à 5 - MATADOR 50EC (200 ml/ha), traitements 6 à 10 - FURADAN 480F (1.1L/ha), traitement 11- EAU et traitement 12 - TÉMOIN. Les pulvérisations ont été effectuées tôt le matin à l'aide d'un pulvérisateur à rampe (SCS 450, Grégoire et fils) monté sur tracteur (pression: 500-700 kPa). Quatre rangs étaient traités et les autres 4 rangs servaient de zone tampon. Un volume de 650 L/ha a été utilisé pour préparer les bouillies. Les dates de traitements ont été déterminées en fonction du début de la ponte de la première génération de la pyrale bivoltine. Les premières masses d'œufs ont été observées le 9 juin 2000. Dans les parcelles qui ont reçu trois traitements insecticides, ceux-ci ont été effectués: les 15, 22 et 29 juin. Dans les parcelles à deux traitements, les traitements ont été effectués: les 17 et 24 juin, dans le cas où les traitements débutaient 8 jours après le début de la ponte. Lorsque les traitements débutaient 10 jours après la ponte, ils ont eu lieu les 19 et 26 juin. Finalement, dans les traitements où une seule intervention était réalisée, cette dernière a été faite le 22 juin lorsqu'elle était faite 13 jours après l'observation des premières masses d'œufs et le 24 juin lorsqu'elle était faite 15 jours après. Le nombre et les dates de pulvérisations sont présentés dans le tableau ci-dessous. L'efficacité des traitements a été évaluée le 2 août 2000 selon les méthodes suivantes: 1) en prélevant 20 plants de maïs sélectionnés sur les rangs du centre de chaque parcelle et en comptant le nombre d'épis sains et 2) en calculant le nombre de plants avec une tige trouée sur le total de ces 20 plants. Les données ont été transformées au besoin pour les normaliser.

RÉSULTATS : voir le tableau ci-dessous.

CONCLUSIONS: Les résultats de cet essai ne montrent aucune différence significative entre les traitements. Les très faibles populations de la première génération de la race bivoltine de la pyrale du maïs en 2000 expliquent ces résultats et ne permettent pas d'établir de différence significative entre les traitements tant pour les dommages au niveau des tiges que des épis.

Tableau 1. Efficacité de traitements insecticides contre la première génération de la race bivoltine de la pyrale du maïs sur du maïs sucré hâtif, Saint-Hyacinthe 2000.

Traitements	Nombres de traitements	Début des traitements (nombre de jours après le début de la ponte: 9 juin)	Dates des traitements	Nombre de tiges trouées (sur 20)	Nombre d'épis sains (sur 20)
MATADOR 50EC	3	6	15, 22 et 29 juin	0.6	19
MATADOR 50EC	2	10	19 et 26 juin	0.6	19.6
MATADOR 50EC	1	15	24 juin	1.4	19
MATADOR 50EC	2	8	17 et 24 juin	1.4	19.6
MATADOR 50EC	1	13	22 juin	0.6	20
FURADAN 480F	3	6	15, 22 et 29 juin	1.2	19.6
FURADAN 480F	2	10	19 et 26 juin	1	19.2
FURADAN 480F	1	15	24 juin	1.2	19.8
FURADAN 480F	2	8	17 et 24 juin	1.8	18.8
FURADAN 480F	1	13	22 juin	0.6	19.6
EAU	1	13	22 juin	2.6	8
TÉMOIN	-	-	-	2.2	9.2
Traitement, aucun effet significatif selon l'analyse de variance				ns	ns
R^2				34	36
Coefficient of Variation (%)				87	10

2000 RAPPORT RLD # 41 **SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**
IRAC: 22221531

CULTURE: Maïs sucré, cv. Bodacious
RAVAGEUR: Pyrale du maïs, *Ostrinia nubilalis*

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TITRE: NOMBRE MINIMAL DE TRAITEMENTS INSECTICIDES REQUIS SUR LE MAÏS SUCRÉ POUR UNE RÉPRESSION EFFICACE DE LA RACE UNIVOLTINE DE LA PYRALE DU MAÏS

PRODUITS: RH2485 80WP–INTREPID (méthoxyfenozide) + COMPANION 0,1% volume; RIPCORD 400EC (cyperméthrine); WARRIOR T (lambda-cyhalothrine).

MÉTHODES: L'essai a été réalisé à Saint-Hyacinthe (Québec) selon un dispositif expérimental en blocs complets aléatoires répétés 5 fois. Le maïs a été semé le 17 mai 2000. Les parcelles de 10 m de longueur comprenaient 8 rangs espacés de 76 cm. Les produits utilisés ont été les suivants: traitements 1 à 9 - WARRIOR T (83 ml/ha), traitements 10 à 18 - RH2485 80WP - INTREPID (240g/ha) + COMPANION 0,1% volume, traitement 19 à 27 - RIPCORD 400EC (175ml/ha) et traitement 28 - TÉMOIN. Les pulvérisations ont été effectuées tôt le matin à l'aide d'un pulvérisateur à rampe (SCS 450, Grégoire et fils) monté sur tracteur (pression: 500-700 kPa). Quatre rangs étaient traités et les autres 4 rangs servaient de zone tampon. Un volume de 650 L/ha a été utilisé pour préparer les bouillies.
Les dates de traitements ont été déterminées en fonction du début de la ponte de la race univoltine de la pyrale du maïs. Les premières masses d'œufs ont été observées le 8 juillet 2000. Les traitements ont varié en nombre selon leur début (5, 9, 10, 14, 15 et 19 jours après le début de la ponte) et l'intervalle entre les traitements (7 et 10 jours). Certaines parcelles ont donc reçu trois traitements insecticides, avec un premier traitement 5 ou 9 jours après le début de la ponte et avec des intervalles de 7 ou 10 jours entre less traitements. D'autres parcelles ont été pulvérisées 2 fois avec un premier traitement 10, 14 ou 15 jours après le début de la ponte et avec un intervalle de 7 ou 10 jours entre le premier et le deuxième traitement. Finalement, dans les parcelles où une seule intervention a été réalisée, cette dernière a été faite 15 ou 19 jours après le début de la ponte. Le nombre et les dates des pulvérisations sont présentés dans le tableau ci-dessous. L'efficacité des traitements a été évaluée selon les méthodes suivantes. Le 21 août 2000, 20 plants de maïs ont été sélectionnés sur les rangs du centre de chaque parcelle. Chacun des 20 plants était examiné et le nombre de plants avec une tige trouée et/ou un épi sain a été noté. La différence entre les moyennes a été évaluée avec le test de Waller-Duncan à 5% de probabilité et par des contrastes.

RÉSULTATS: voir le tableau ci-dessous.

CONCLUSIONS: La pression exercée par la pyrale univoltine a été assez importante pour démontrer des différences significatives entre le témoin et les parcelles traitées, tant au niveau des plants avec une tige trouée qu'au niveau des épis sains. Une analyse de contrastes met en évidence un nombre d'épis sains significativement plus élevé avec RIPCORD qu'avec Warrior T ($p<0,05$), mais il n'y avait aucune différence significative entre RH-2485 et ces deux produits. Au niveau du nombre de traitements, cette même analyse indique aucune différence significative entre une cédule à 1, 2 et 3 traitements (dommages aux épis). Une cédule avec 2 traitements procure significativement moins de dommages aux tiges qu'une avec un seul traitement. Aucune tendance n'a pu être démontrée dans cette analyse quant au délai après la ponte et l'intervalle entre les traitements.

Tableau 1. Efficacité de traitements insecticides contre la race univoltine de la pyrale du maïs sur du maïs sucré de saison, Saint-Hyacinthe 2000.

Traitements	Nombre de traitements et intervalles entre les traitements ( )	Début des traitements[1]	Dates des traitements	Nombre de tiges trouées (sur 20)[2]	Nombre d'épis sains (sur 20)[3]
WARRIOR T	3 (7)	5	13, 20 et 27 juillet	0.20 bc	19.80 a
WARRIOR T	2 (7)	10	18 et 25 juillet	0.00 c	20.00 a
WARRIOR T	1	15	23 juillet	0.80 abc	19.60 ab
WARRIOR T	3 (7)	9	17, 24 et 31 juillet	0.60 bc	19.40 ab
WARRIOR T	2 (7)	14	22 et 29 juillet	0.00 c	19.60 ab
WARRIOR T	1	19	27 juillet	1.40 ab	19.60 ab
WARRIOR T	3 (10)	5	13, 23 juillet et 3 août	0.00 c	19.80 a
WARRIOR T	2 (10)	10	18 et 28 juillet	0.20 bc	20.00 a
WARRIOR T	2 (10)	15	23 juillet et 3 août	0.20 bc	20.00 a
RH-2485	3 (7)	5	13, 20 et 27 juillet	0.20 bc	20.00 a
RH-2485	2 (7)	10	18 et 25 juillet	0.00 c	20.00 a
RH-2485	1	15	23 juillet	1.20 ab	19.80 a
RH-2485	3 (7)	9	17, 24 et 31 juillet	0.60 abc	20.00 a
RH-2485	2 (7)	14	22 et 29 juillet	0.80 abc	19.60 ab
RH-2485	1	19	27 juillet	0.40 bc	20.00 a
RH-2485	3 (10)	5	13, 23 juillet et 3 août	0.20 bc	20.00 a
RH-2485	2 (10)	10	18 et 28 juillet	0.40 bc	19.80 a
RH-2485	2 (10	15	23 juillet et 3 août	0.00 c	20.00 a
RIPCORD 400	3 (7)	5	13, 20 et 27 juillet	0.00 c	20.00 a
RIPCORD 400	2 (7)	10	18 et 25 juillet	0.00 c	20.00 a
RIPCORD 400	1	15	23 juillet	0.40 bc	19.80 a
RIPCORD 400	3(7)	9	17, 24 et 31 juillet	0.00 c	20.00 a
RIPCORD 400	2(7)	14	22 et 29 juillet	0.00 c	20.00 a
RIPCORD 400	1	19	27 juillet	0.60 bc	20.00 a
RIPCORD 400	3(10)	5	13, 23 juillet et 3 août	0.20 bc	20.00 a
RIPCORD 400	2(10)	10	18 et 28 juillet	0.20 bc	19.80 a
RIPCORD 400	2(10	15	23 juillet et 3 août	0.00 c	20.00 a
TÉMOIN	-	-	-	1.80 a	19.00 b
Traitement, niveau significatif selon l'analyse de variance				<0,01	<0,05
R^2				0,36	0,31
Coefficient of Variation (%)				34	2

[1] nombre de jours après le début de la ponte: 8 juillet.

[2] Ces données sont les moyennes de 5 répétitions et elles ont été transformées au besoin avant de faire les analyses de variances.

[3] Les moyennes suivies d'une même lettre ne sont pas significativement différentes à un seuil de 5% de probabilité selon le test de Waller-Duncan.

2000 RAPPORT RLD # 42

SECTION B: INSECTES DES LÉGUMES ET CULTURES SPÉCIALES
BASE DE DONNÉES DES ÉTUDES: 22221532

CULTURE: Maïs sucré, cv. Délectable
RAVAGEUR: Pyrale du maïs, *Ostrinia nubilalis*

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TITRE: ESSAIS DE TRAITEMENTS INSECTICIDES SUR LE MAÏS SUCRÉ TARDIF CONTRE LA DEUXIÈME GÉNÉRATION DE LA RACE BIVOLTINE DE LA PYRALE DU MAÏS ET LES AUTRES INSECTES NUISIBLES EN FIN DE SAISON

PRODUITS: BIOPROTEC (*Bacillus thuringiensis* var. kurstaki) + TRITON; RIPCORD 400EC (cyperméthrine); WARRIOR T (lambda-cyhalothrine).

MÉTHODES: L'essai a été réalisé à Saint-Hyacinthe (Québec) selon un dispositif expérimental en blocs complets aléatoires répétés 5 fois. Le maïs a été semé le 13 juin 2000. Les parcelles de 10 m de longueur comprenaient 8 rangs espacés de 76 cm. Les produits utilisés ont été les suivants: traitements 1 à 6 - WARRIOR T (83 ml/ha), traitements 7 à 12 - RIPCORD 400EC (175ml/ha), traitements 13 à 18 - BIOPROTEC (3,4L/ha + TRITON (175ml/ha) et traitement 19 - TÉMOIN. Les pulvérisations ont été effectuées tôt le matin à l'aide d'un pulvérisateur à rampe (SCS 450, Grégoire et fils) monté sur tracteur (pression: 500-700kPa). Quatre rangs étaient traités et les autres 4 rangs servaient de zone tampon. Un volume de 650 L/ha a été utilisé pour préparer les bouillies. Les dates de traitements ont été déterminées en fonction du début de la ponte de la deuxième génération de la race bivoltine de la pyrale du maïs. Les premières masses d'œufs ont été observées le 1^er^ août 2000. Les traitements ont varié en nombre selon leur début (5, 9 et 14 jours après le début de la ponte) et l'intervalle entre les traitements (7 et 10 jours). Certaines parcelles ont donc reçu trois traitements insecticides, avec un premier traitement 5 ou 9 jours après le début de la ponte et avec des intervalles de 7 ou 10 jours entre eux. D'autres parcelles ont été pulvérisées 2 fois avec un premier traitement 9 ou 14 jours après le début de la ponte et avec un intervalle de 7 ou 10 jours entre le premier et le deuxième traitement. Le nombre et les dates de pulvérisation sont présentés dans le tableau ci-dessous. L'efficacité des traitements a été évaluée le18 septembre 2000 selon les méthodes suivantes: 1) en prélevant 20 plants de maïs sélectionnés sur les rangs du centre de chaque parcelle et en comptant le nombre d'épis sains et 2) en calculant le nombre de plants avec une tige trouée sur le total de ces 20 plants. La différence entre les moyennes a été évaluée avec le test de Waller-Duncan à 5% de probabilité et par des contrastes.

RÉSULTATS: voir le tableau ci-dessous.

CONCLUSIONS : La pression exercée par la deuxième génération de la pyrale bivoltine a été assez importante pour démontrer des différences significatives entre le témoin et les parcelles traitées, tant au niveau des plants avec une tige trouée qu'au niveau des épis sains. Une analyse de contrastes met en évidence un nombre d'épis sains significativement plus élevé avec Warrior T et Ripcord qu'avec Bioprotec (p<0,05), mais il n'y avait aucune différence significative entre Warrior T et Ripcord. Au niveau du nombre de traitements, cette même analyse indique aucune différence significative entre une cédule à 2 et 3 traitements (nombre d'épis sains). Une cédule avec 3 traitements procure significativement moins de dommages aux tiges qu'une avec 2 traitements. Une cédule de 2 traitements (intervalle de 7 jours entre les traitements) commençant 14 jours après le début de la ponte occasionnerait significativement plus de dommages aux tiges qu'une de 3 traitements (intervalle de 7 jours entre les traitements) débutant 5 jours après les premières masses d'oeufs. Aucune tendance n'a pu être démontrée dans cette analyse quant à l'intervalle entre les traitements.

Tableau 1. Efficacité de traitements insecticides contre la deuxième génération de la race bivoltine de la pyrale du maïs sur du maïs sucré tardif, Saint-Hyacinthe 2000.

Traitements	Nombre de traitements et intervalle entre les traitements ( )	Début des traitements[1]	Dates des traitements	Nombre de tiges trouées (sur 20)[2]	Nombre d'épis sains (sur 20)[3]
WARRIOR T	3 (7)	5	6, 13 et 20 août	1.40 def	19.80 ab
WARRIOR T	3 (7)	9	10, 17 et 24 août	1.40 def	19.80 ab
WARRIOR T	3 (10)	5	6, 17 et 24 août	0.80 f	20.00 a
WARRIOR T	3 (10)	9	10, 20 et 31 août	1.00 ef	19.80 ab
WARRIOR T	2 (7)	9	10 et 17 août	3.60 bcd	20.00 a
WARRIOR T	2 (10)	14	15 et 25 août	1.80 cdef	19.20 bcd
RIPCORD 400EC	3 (7)	5	6, 13 et 20 août	1.80 cdef	19.80 ab
RIPCORD 400EC	3 (7)	9	10, 17 et 24 août	2.40 cdef	19.40 ab
RIPCORD 400EC	3 (10)	5	6, 17 et 24 août	1.20 def	20.00 a
RIPCORD 400EC	3 (10)	9	10, 20 et 31 août	1.20 def	18.80 def
RIPCORD 400EC	2 (7)	9	10 et 17 août	2.20 cdef	19.80 ab
RIPCORD 400EC	2 (10)	14	15 et 25 août	2.00 cdef	19.60 abc
BIOPROTEC	3 (7)	5	6, 13 et 20 août	1.60 cdef	18.30 def
BIOPROTEC	3 (7)	9	10, 17 et 24 août	2.40 cdef	18.80 cde
BIOPROTEC	3 (10)	5	6, 17 et 24 août	4.00 bc	16.60 gh
BIOPROTEC	3 (10)	9	10, 20 et 31 août	3.60 bcd	18.20 efg
BIOPROTEC	2 (7)	9	10 et 17 août	3.40 bcde	17.20 fgh
BIOPROTEC	2 (10)	14	15 et 25 août	5.00 ab	17.20 efg
TÉMOIN	-	-	-	7.00 a	15.20 h
Traitement, niveau significatif selon l'analyse de variance				<0,001	<0,001
R^2				0,46	0,66
Coefficient of Variation (%)				80	9

[1] nombre de jours après le début de la ponte: 1er août.

[2] Ces données sont les moyennes de 5 répétitions et elles ont été transformées au besoin avant de faire les analyses de variances.

[3] Les moyennes suivies d'une même lettre ne sont pas significativement différentes, à un seuil de 5% de probabilité selon de test de Waller-Duncan.

2000 PMR REPORT # 43 **SECTION B: INSECT PESTS OF VEGETABLE and SPECIAL CROPS**

CROP: Sweet corn (*Zea mays saccharata* L.), cv. Chippawa (70 day maturity)
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hubner)

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TITLE: EFFICACY OF SUCCESS 480 SC COMPARED TO FURADAN 4 F AND RIPCORD 400 EC AGAINST EUROPEAN CORN BORER IN SWEET CORN CV. CHIPPAWA ON SANDY SOIL, 2000

MATERIALS: SUCCESS 480 SC (spinosad, *Saccharopolyspora spinosa*), FURADAN 4 F (carbofuran), RIPCORD 400 EC (cypermethrin).

METHODS: Sweet corn cv. Chippawa (70 day maturity) was seeded at the Cambridge Research Station on 11 May, 2000 in 4 row blocks, 15 m long. Rows were spaced on 0.75 m centers with 20 – 22 cm plant spacing. Three meter spray lanes separated the blocks. The seven treatments, replicated four times, were arranged in a randomized complete block design. ECB populations were monitored for consistency across the field using pheromone traps (univoltine Iowa strain lures, Bioforest Technologies Inc., Sault Ste. Marie, Ontario). Foliar insecticides were applied to all 4 rows of each 4 row block, using a tractor-mounted, four row boom sprayer that delivered 1000 L/ha at 450 kPa (Teejet nozzles # 8003 VS). Treatments were applied on 3 and 10 August, with the first application occurring when the crop was tasselling, approximately 10 days to 2 weeks before maturity. The sweet corn was harvested on 23 August, by sampling 25 ears from the center two rows of each plot. ECB control was determined by examining the 25 ears for tunnelling on the husk and the ear, counting the number of larvae per ear and assessing each ear's marketability. Marketable considerations included ear size, tip fill and colour. A rating scale of 0-10 was used, where ratings of 6 or less were considered unmarketable. Results were analyzed using analysis of variance and Duncan's New Multiple Range Test ($p<0.05$).

RESULTS: As outlined in Table 1.

CONCLUSIONS: Significantly fewer ECB larvae were found in plots treated with all treatment rates of SUCCESS (40 – 120 g a.i./ha) than in the untreated check or plots treated with FURADAN or RIPCORD. There were no significant differences among the numbers of ECB found in untreated plots or in plots treated with FURADAN or RIPCORD. While all harvested ears were marketable, highest scores were recorded in plots treated with SUCCESS at 120 g a.i./ha (8.3) and lowest scores in plots treated with FURADAN (6.3). Considering the superior control provided by SUCCESS in this trial, SUCCESS warrants consideration for registration for ECB-control in sweet corn.

Table 1. Efficacy of SUCCESS 480 SC compared to FURADAN 4F and RIPCORD 400 EC against European corn borer in sweet corn cv. Chippawa, 2000.

Treatments	Rate (g a.i./ha)	Number of Tunnels on the Husk	Number of Tunnels in the Ear	Number of Larvae / Ear	Marketability (0-10 scale)
Untreated	--	0.9 b[1]	1.1 a	0.7 a	6.7 cd
SUCCESS 480 SC	40 + 40	0.9 b	0.3 b	0.2 b	7.6 abc
SUCCESS 480 SC	60 + 60	1.3 ab	0.5 b	0.2 b	7.9 ab
SUCCESS 480 SC	80 + 80	1.3 ab	0.4 b	0.2 b	8.1 ab
SUCCESS 480 SC	120 +	0.9 b	0.3 b	0.1 b	8.3 a
FURADAN 4 F	530 + 530	1.8 a	1.0 a	0.7 a	6.3 d
RIPCORD 400 EC	70 + 70	1.5 ab	0.7 ab	0.4 ab	7.1 bcd

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Duncan's New MRT).

2000 PMR REPORT # 44 **SECTION B: INSECT PESTS OF VEGETABLES and SPECIAL CROPS**

CROP: Sweet corn (*Zea mays saccharata* L.), cv. Delectable (82 day maturity)
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hubner)

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TITLE: EFFICACY OF SUCCESS 480 SC COMPARED TO FURADAN 4 F AND RIPCORD 400 EC AGAINST EUROPEAN CORN BORER IN SWEET CORN CV. DELECTABLE ON SANDY SOIL, 2000

MATERIALS: SUCCESS 480 SC (spinosad, *Saccharopolyspora spinosa*), FURADAN 4 F (carbofuran), RIPCORD 400 EC (cypermethrin)

METHODS: Sweet corn cv. Delectable (82 day maturity) was seeded at the Cambridge Research Station on 17 May, 2000 in 4 row blocks, 15 m long. Rows were spaced on 0.75 m centers with 20 - 22 cm plant spacing. Three meter spray lanes separated the blocks. The seven treatments, replicated four times, were arranged in a randomized complete block design. ECB populations were monitored for consistency across the field using pheromone traps (univoltine Iowa strain lures, Bioforest Technologies Inc., Sault Ste. Marie, Ontario). Foliar insecticides were applied to all 4 rows of each 4 row block, using a tractor-mounted, four row boom sprayer that delivered 1000 L/ha at 450 kPa (Teejet nozzles # 8003 VS). Treatments were applied on 3 and 10 August, with the first application occurring when the crop was tasselling, approximately 10 days to 2 weeks before maturity. The sweet corn was harvested on 24 August, by sampling 25 ears from the center two rows of each plot. ECB control was determined by examining the 25 ears for tunnelling on the husk and the ear, counting the number of larvae per ear and assessing each ear's marketability. Marketable considerations included ear size, tip fill and colour. A rating scale of 0-10 was used, where ratings of 6 or less were considered unmarketable. Results were analyzed using analysis of variance and Duncan's New Multiple Range Test ($p<0.05$).

RESULTS: As outlined in Table 1.

CONCLUSIONS: All SUCCESS treatment rates (40 - 120 g a.i./ha) provided significant reductions in the amount of damage inflicted by ECB as compared to the untreated check. In all evaluations, SUCCESS (all rates) provided equivalent or improved control over FURADAN and RIPCORD (industry standards). All sweet corn ears assessed at harvest were marketable with ears harvested from SUCCESS at 60 g a.i./ha being the most marketable (8.4) and the untreated check the least marketable (6.9). Therefore, since SUCCESS provided equivalent efficacy to FURADAN and RIPCORD, it should be considered as an alternative ECB control product in sweet corn.

Table 1. Efficacy of SUCCESS 480 SC compared to FURADAN 4F and RIPCORD 400 EC against European corn borer in sweet corn cv. Delectable, 2000.

Treatments	Rate (g a.i./ha)	Number of Tunnels on the Husk	Number of Tunnels in the Ear	Number of Larvae / Ear	Marketability (0-10 scale)
Untreated	--	2.3 a[1]	0.7 a	0.5 a	6.9 c
SUCCESS 480 SC	40 + 40	1.0 b	0.0 b	0.1 b	7.8 b
SUCCESS 480 SC	60 + 60	0.9 b	0.0 b	0.0 b	8.4 a
SUCCESS 480 SC	80 + 80	0.9 b	0.0 b	0.0 b	8.0 ab
SUCCESS 480 SC	120 +120	0.8 b	0.0 b	0.0 b	7.7 b
FURADAN 4 F	530 + 530	1.1 b	0.2 b	0.1 b	8.1 ab
RIPCORD 400 EC	70 + 70	1.7 ab	0.2 b	0.1 b	7.7 b

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Duncan's New MRT).

CROP: Transplanted tomatoes (*Lycopersicon esculentum* L.), cv. 9478
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say.)

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TITLE: EFFICACY OF SUCCESS 480 SC COMPARED TO ADMIRE 240 SC AGAINST COLORADO POTATO BEETLE IN TOMATOES ON SANDY SOIL, 2000

MATERIALS: SUCCESS 480 SC (spinosad, *Saccharopolyspora spinosa*), ADMIRE 240 F (imidacloprid)

METHODS: Processing tomato plugs, cv. 9478, were transplanted at the Cambridge Research Station on 24 May, 2000 in 4 row blocks, 10 m long. Rows were spaced on 0.75 m centers with 50 cm plant spacing. Three meter spray lanes separated the blocks. The seven treatments, replicated four times, were arranged in a randomized complete block design. CPB populations were monitored and reached such high densities by 15 June, that an overspray (SUCCESS at 60 g a.i./ha) was required to save the trial. Subsequently, CPB infestation levels did not reach economic thresholds, so the trial was inoculated on 27 June, by placing one egg mass on each of 5 plants per plot, and then marking each plant for further evaluations. Foliar insecticides were applied to all 4 rows of each 4 row block, using a tractor-mounted, four row boom sprayer that delivered 750 L/ha at 500 kPa (Colorjet nozzles # 80-28). Treatments were applied on 30 June and 6 July, with the first application occurring at 30% egg hatch with CPB (egg masses, larvae and adults) infestation levels at 2.5/plant. CPB efficacy was determined by counting the number of egg masses, larvae and adults at 6, 13 and 20 days after the first application. The tomatoes were harvested on 29 August, by removing the 5 inoculated plants from each plot. Total plant weight, total fruit number, number of red and green fruit, total fruit weight, and red and green fruit weights were recorded. Results were analyzed using analysis of variance and Duncan's New Multiple Range Test ($p<0.05$).

RESULTS: As outlined in Tables 1 and 2.

CONCLUSIONS: Significantly fewer CPB were counted in all treated plots than in untreated plots. There were no significant differences among treatments due to the low CPB densities. Small differences in yield occurred between ADMIRE (50 g a.i./ha) and SUCCESS (80 g a.i./ha) in total number of fruit and total number of green fruit / 5 plants. Differences between ADMIRE (50 g a.i./ha) and the untreated occurred in the mean total plant weight, mean number of fruit, mean number of red and green fruit and total fruit weight / 5 plants. While, it appears that SUCCESS provides similar efficacy and yield results as the commercial standard ADMIRE, higher CPB infestation levels would clarify these results.

Table 1. Efficacy of SUCCESS 480 SC compared to ADMIRE 240 F against Colorado potato beetle at 30% egg hatch in tomatoes on sandy soil, 2000.

Treatments	Rate (g a.i./ha)	Mean number of CPB[1]/ 5 plants on indicated day		
		Day 6	Day 13	Day 20
Untreated	--	2.5 a[2]	0.8 a	1.1 a
SUCCESS 480 SC	60 + 60	0.0 b	0.0 b	0.0 b
SUCCESS 480 SC	60	0.0 b	0.0 b	0.0 b
SUCCESS 480 SC	80	0.1 b	0.0 b	0.0 b
ADMIRE 240 F	50 +50	0.0 b	0.0 b	0.1 b
ADMIRE 240 F	50	0.0 b	0.0 b	0.0 b
ADMIRE 240 F	70	0.0 b	0.0 b	0.0 b

[1] Number of CPB = number of egg masses, larvae and adults present (all counted together due to low infestation levels).

[2] Treatment means followed by the same letter are not significantly different (p=0.05, Duncan's New MRT).

Table 2. Relative impact of SUCCESS 480 SC and ADMIRE 240 F on yield of tomatoes on sandy soil, 2000.

Treatments	Rate (g a.i./ha)	Mean plant weight (kg) / 5 plants	Mean fruit number / 5 plants	Mean number of green fruit / 5 plants	Mean number of red fruit / 5 plants	Mean fruit weight (kg) / 5 plants
Untreated	--	1.85 b[1]	52.3 c	31.1 c	20.1 ab	0.94 a
SUCCESS 480 SC	60 + 60	2.62 ab	71.3 ab	50.6 ab	20.8 a	1.03 a
SUCCESS 480 SC	60	2.41 ab	69.6 abc	49.5 abc	20.1 ab	0.93 a
SUCCESS 480 SC	80	2.15 ab	59.7 bc	39.7 bc	20.2 ab	0.95 a
ADMIRE 240 F	50 + 50	2.50 ab	66.6 abc	46.3 bc	20.4 ab	1.00 a
ADMIRE 240 F	50	2.89 a	81.6 a	67.2 a	14.4 b	0.77 a
ADMIRE 240 F	70	2.67 ab	73.6 ab	55.1 ab	18.0 ab	0.95 a

[1] Treatment means followed by the same letter are not significantly different (p=0.05, Duncan's New MRT).

2000 PMR REPORT # 46 **SECTION B: INSECTS OF VEGETABLES AND SPECIAL CROPS**
STUDY DATA BASE: 280-1252-9904

CROP: Summer Turnip, cv. Purple Top White Globe
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: EVALUATION OF DRENCH TREATMENTS FOR CONTROL OF CABBAGE MAGGOT ATTACKING SUMMER TURNIP IN MINERAL SOIL, 2000

MATERIALS: ACTARA 25 WG (thiamethoxam), BOTANIGARD (*Beauveria bassiana*)(2.1 x 10^{13} viable spores/L), CANON 200 SC (fipronil), LORSBAN 4 E (chlorpyrifos)

METHODS: Summer turnip seed was planted on the London Research Farm of the Southern Crop Protection and Food Research Centre on May 15 in 1-row microplots (2.25 m long x 0.9 m wide) filled with insecticide-residue-free mineral soil. All treatments were replicated three times in a randomized complete block design. On June 6 when seedlings had 4-6 true leaves, PRE drench treatments were applied at 175 kPa in 20 L/100 m row in a 5-7 cm band over crown of developing plant, using a hand-held, CO_2-pressurized, single-nozzled (4006E flat fan) R&D plot sprayer. On June 16, to augment the native CM population, 200-250 CM eggs from an insecticide-susceptible, laboratory strain, originally collected near Chatham, ON, were buried 1 cm deep beside developing plants beside an approximate 1.0-1.3 m length of row in each plot. To improve egg hatch and maggot survival, plots were watered after infestation. The infested row length was delineated with a dated, plastic plant marker (1.5 cm x 12.5 cm). On June 20, POST drench insecticides were applied as described above. On July 12, the 15 largest turnips from both the artificially augmented and the naturally infested lengths of row in each plot were carefully pulled, washed and placed inside appropriately labelled plastic bags. All samples were then stored at 4°C until rated for CM feeding damage according to the rating scale developed by King and Forbes (1954) (See footnote, Table 1). Within each plot separate rating scores were developed for roots damaged by the augmented CM population and for turnips damaged only by wild CM. A Damage Index (D.I.) was then calculated for each group of turnips in each plot by multiplying the appropriate factor by the % of roots in each category, adding products and dividing the sum by 4. Statistical significance of observed impact of drench application on CM-injury was determined by analysis of variance. Significance of differences among treatments means was determined using a Least Significant Difference Test. Mean % Control of CM-damage by each drench treatment was calculated according to the formula: % Control = D.I.(Control) - D.I.(Tmt.)/D.I.(Control) x 100%.

RESULTS/OBSERVATIONS: Results are presented in Table 1. Augmenting the natural CM by burial of laboratory produced CM-eggs beside growing turnip roots increased the mean damage indices in untreated plots (Tmt. 12). Both PRE and POST application of LORSBAN (Tmt. 10, 11) provided excellent and effective control of damage by both natural and augmented CM-populations. PRE application of the higher rate (Tmt. 2) and POST application of both rates of CANON (Tmt. 3, 4) significantly reduced damage to turnips by the augmented CM-population. Only POST application of the higher rate of CANON significantly reduced damage by the natural CM-population; control by this treatment was equal to that provided by LORSBAN. No application of ACTARA alone (Tmts. 5-8) had any significant impact on CM-damage to turnip. Addition of BOTANIGARD to ACTARA (Tmt. 9) did not improve control of CM-damage.

No phytotoxicity was observed following any treatment.

CONCLUSIONS: Drench application of the current commercial standard LORSBAN effectively and consistently controlled feeding damage by both natural and augmented CM-populations. While no experimental insecticide consistently controlled CM-damage to turnips as effectively as LORSBAN, drench application CANON significantly reduced CM-damage. CANON thus appeared a promising insecticide for protection of summer turnip from feeding damage by CM. At tested rates and timing of application, ACTARA did not effectively control CM-damage.

Table 1. Experimental drench treatments for control of cabbage maggot, *Delia radicum*, attacking summer turnip in mineral soil in microplots, London, ON, 2000.

Tmt. No.	Treatment Applied	Rate Applied (pdct/ 100 m)	Timing[1]	Treatment-Impact for Indicated CM Population			
				Augmented[2] Population		Natural[3] Population	
				Dam. Index[4]	% Control[5]	Dam. Index	% Control
1.	CANON 200SC	5.0 ml	PRE	56.8 abc[6]	14.8	54.4 abc	0.0
2.	CANON 200SC	10.0 ml	PRE	21.1 def	68.4	35.5 c	6.1
3.	CANON 200SC	5.0 ml	POST	30.1 cdef	54.9	28.9 cd	23.5
4.	CANON 200SC	10.0 ml	POST	27.8 cdef	58.3	4.5 d	88.1
5.	ACTARA 25WG	8.0 g	PRE	79.9 a	0.0	67.8 a	0.0
6.	ACTARA 25WG	12.0 g	PRE	52.2 abcd	21.7	48.9 abc	0.0
7.	ACTARA 25WG	8.0 g	POST	38.9 bcde	41.7	64.5 ab	0.0
8.	ACTARA 25WG	12.0 g	POST	52.2 abcd	21.7	47.8 abc	0.0
9.	ACTARA 25WG + BOTANIGARD	12.0 g + 30.0 ml	PRE	72.2 ab	0.0	48.9 abc	0.0
10.	LORSBAN 4E	21.0 ml	PRE	1.1 f	98.4	6.1 d	83.8
11.	LORSBAN 4E	21.0 ml	POST	11.1 ef	83.4	3.3 d	91.3
12.	CONTROL[7]	—	—	66.7 ab	—	37.8 bc	—

[1] PRE - insecticide applied 10 days prior to CM-egg infestation; POST - insecticide applied 4 days after infestation.

[2] 200-250 CM-eggs buried adjacent to row.

[3] root injury solely due to feeding by maggots hatching from eggs deposited by native CM-flies.

[4] Damage Index (D.I.) (King and Forbes, 1954) - harvested roots rated for feeding damage according to the following scale: **clean** - factor of 0, no damage; **light** - factor of 1, slight, superficial early feeding but fully healed; **moderate** - factor of 2, marketable as Grade 2 after single trim just above tap root to remove single deep penetration or, moderate, healed surface injury affecting < 20% of surface that could be removed by peeling; **severe** - factor of 4, unmarketable for table use; injury not removable by practical trimming; any extensive unhealed surface injury; maggot in root. D.I. was then calculated for each group of turnips in each plot by multiplying appropriate factor by the % of roots in each category, adding products and dividing sum by 4.

[5] Mean % Control relative to Damage Index (D.I.) for Untreated plots.
% Control = D.I.(Control) - D.I.(Tmt.)/D.I.(Control) x 100%

[6] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using a Least Significant Difference Range Test.

[7] no insecticide.

END OF SECTION B - INSECT PESTS OF VEGETABLES AND SPECIAL CROPS
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SECTION C: **POTATOES/POMMES DE TERRE**

REPORT/RAPPORT #: **47 - 52**

PAGES: **105 - 126**

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2000 RAPPORT RLD # 47 **SECTION C : INSECTES DES POMMES DE TERRE**
BASE DE DONNÉES DES ÉTUDES : 86000718

CULTURE : Pomme de terre, cv. Superior
RAVAGEUR : Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say)

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TITRE : EFFICACITÉ DU ACTARA APPLIQUÉ AU SOL ET SUR LE FEUILLAGE CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 2000

PRODUITS : ACTARA 25 WG (thiamethoxam 25 %), THIAMETHOXAM SC (thiamethoxam 240 g/L), ADMIRE 240F (imidacloprid 240 g/L).

MÉTHODES : L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 19 mai 2000 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 8 rangs espacés de 0,9 m. Les traitements étaient les suivants : 1. THIAMETHOXAM en bandes au sol à la plantation (dose 380 mL/ha);
2. THIAMETHOXAM en bandes au sol à la plantation (dose 485 mL/ha); 3. ACTARA en pulvérisations foliaires; 4. ADMIRE en pulvérisations foliaires; 5 ADMIRE en bandes au sol à la plantation;
et 6. TÉMOIN (sans traitement). Lors de la première intervention foliaire, la population larvaire était composée à 70 % de larves de stade 1 et 2. Pour les traitements prévoyant des pulvérisations foliaires, celles-ci ont été faites le 13 juillet et le 21 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression : 690 kPa, volume : 450 L/ha). Dans le cas de l'application au sol, nous avons utilisé un pulvérisateur monté sur une roue de bicyclette et poussé manuellement (pression : 200 kPa, volume : 100 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les six rangées du centre. Le dommage au feuillage a été évalué visuellement par une estimation en pourcentage de défoliation du plant. Les plants de pommes de terre ont été défanés une première fois le 25 août avec du RÉGLONE (diquat 2,5 L p.c./ha) et le 31 août avec le même produit (diquat 1,5L p.c./ha). Le rendement

en tubercules a été déterminé à partir de la récolte des six rangées du centre de chaque parcelle faite le 13 septembre 2000.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSION : À Deschambault, en 2000, la saison n'a pas été très favorable au développement du doryphore de la pomme de terre. Les populations larvaires sont demeurées relativement faibles. Par contre, le climat a favorisé une croissance vigoureuse des plants. Dans ces circonstances, seul l'insecticide ACTARA appliqué au sol ou en pulvérisation foliaire a permis d'obtenir un rendement supérieur à un témoin non traité. L'efficacité des traitements au ADMIRE appliqué au sol et au feuillage, se situe à mi-chemin entre le ACTARA (sol et feuillage) et le témoin non traité. L'efficacité de l'insecticide THIAMETHOXAM à contrôler également d'autres insectes de la pomme de terre, comme l'altise, Epitrix cucumeris (Harris), particulièrement lorsqu'il est appliqué au sol, pourrait expliquer en grande partie la très bonne performance de ce produit. Au niveau des populations larvaires, les traitements au sol avec le THIAMETHOXAM et le ADMIRE ont été équivalents en début de saison mais se sont écartés avec une baisse d'efficacité du ADMIRE à la fin de juillet. Le THIAMETHOXAM utilisé au sol à la dose 485 ml/ha, s'est montré légèrement supérieur à la dose 380 ml/ha, à la toute fin de la saison. Pour ce qui est des traitements foliaires, l'efficacité entre le ACTARA et le ADMIRE a été très comparable pour le contrôle de la population larvaire. On peut observer que les traitements foliaires (ACTARA et ADMIRE) se sont démarqués par rapport aux traitements au sol (THIAMÉTHOXAM et ADMIRE), en étant plus efficace pour maintenir les populations larvaires à un niveau bas en fin de saison. Dans l'ensemble, les résultats obtenus au niveau du dommage au feuillage sont le reflet de ceux observés au niveau de la population larvaire. Pour la plupart des traitements, les dommages ont été plutôt faibles ou quasiment nuls dans le cas du traitement au sol avec le THIAMETHOXAM à la dose la plus élevée.

Table 1. Nombre moyen de larves de doryphore/plant, dommage en % et rendement vendable, Deschambault, Québec, 2000.

Traitement Insecticide	Dose (p.c. /ha)	Population larvaire[1]					Dommage					Rendement vendable (t/ha)
		Juillet			Août		Juillet			Août		
		11	19	27	3	10	12	21	27	4	10	
THIAMETHOXAM au sol	485 ml	0,0c	0,1d	0,0c	0,0c	0,0c	0,0b	0,0d	0,0c	0,3c	0,3b	62,4a[2]
THIAMETHOXAM au sol	380 ml	0,0c	0,1d	0,0c	0,1c	0,5b	0,0b	0,0d	0,0c	0,5bc	1,0b	61,5a
ACTARA foliaire	104 g	12,3b	5,7b	0,0c	0,0c	0,0c	1,0a	1,0bc	1,3b	1,5bc	1,5b	60,2a
ADMIRE foliaire	200 ml	14,9b	3,4c	0,2c	0,0c	0,1c	1,0a	1,5b	2,0b	2,8b	2,8b	56,6ab
ADMIRE au sol	850 ml	0,0c	0,0d	1,4b	3,4b	3,0a	0,0b	0,3cd	1,5b	2,8b	2,8b	56,2ab
TÉMOIN	---	19,0a	34,3a	19,5a	7,7a	2,9a	1,5a	12,0a	23,8a	37,5a	43,8a	48,0b

[1] Les données de population larvaire ont été transformées selon la formule log ($x + 1$) avant l'analyse de la variance. Les données pour le dommage ont été transformées selon la formule arsin ($\sqrt{x}$ /100). Ces données sont présentées non transformées dans le tableau.

[2] Les résultats suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

2000 PMR REPORT # 48 **SECTION C: POTATO INSECTS**
STUDY DATA BASE: 303-1251-9601

CROP: Potato, cv. Shepody
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato flea beetle (PFB), *Epitrix cucumeris* (Harris)
Aphids

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TITLE: EFFECT OF SEED-PIECE OR IN-FURROW INSECTICIDE TREATMENTS ON POTATOES PLANTED AT TWO SEEDING RATES

MATERIALS: CLEAN CROP 8% (mancozeb), GAUCHO MZ 1.25% (imidacloprid & mancozeb), and ADMIRE 240 F (imidacloprid)

METHODS: Cut seed potato pieces were planted at Harrington, PEI, on May 31, 2000, in four-row plots with plant spacing of either 0.3 m (treatments 11 through 14) or 0.5 m (treatments 21 through 24) within rows, and 0.9 m between rows. Plots were arranged in a split-plot design, with the main effect being the seeding rate, and the secondary being the presence/absence and rate of insecticide. There were four replications. The plots measured 7.6 m in length and 3.7 m in width, and were separated from each other within each replicate by two buffer rows of potatoes. All treatments consisted of either a pre-plant seed-piece application or an in-furrow application at planting, and were as follows: 11 and 21) Check - CLEAN CROP 8% at 30 g AI/100 kg seed; 12 and 22) GAUCHO MZ at 6.3 g AI/100 kg seed; 13 and 23) GAUCHO MZ at 9.4 g AI/100 kg seed; and 14 and 24) ADMIRE 240 F in-furrow at 1.8 g AI/100 m row at planting after CLEAN CROP 8% at 30 g AI/100 kg seed. Beginning when Colorado potato beetle adults first appeared in the plots, weekly counts of the numbers of CPB egg masses, adults, early-instars (L1-L2), and late-instars (L3-L4) on five whole plants per plot were done. On the same schedule, determinations of PFB population levels were made by counting the number of holes in a fourth terminal leaf of each plant, and aphids were counted on a top, middle, and bottom leaf of the same plant. Percent defoliation in each plot was estimated weekly throughout the growing season. After planting, a pre-emergence application of metribuzin at 1.1 kg AI/ha was applied to plots for weed control. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha, and of propamocarb at 1.6 kg AI/ha, for late blight control. There was no need to spray the buffer rows to prevent the inter-plot movement of insects. Diquat was applied at the rate of 370 g AI/ha on September 25 for top desiccation. Tubers from the centre two rows of each plot were harvested on 2 October, and total and marketable (wt.>33 g) yields were recorded. Fifty tubers per plot from treatments 21 through 24 were examined for wireworm damage as determined by the number of wireworm holes per tuber. Analyses of variance were performed on the data and Least Significant Differences (LSD) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine(prop)) before analysis. Untransformed means are presented.

RESULTS: Regardless of seed spacing, GAUCHO MZ at 6.3 and 9.4 g AI/100 kg seed, and ADMIRE 240 F in-furrow at 1.8 g AI/100 m row, were equally efficacious at reducing numbers of CPB adults on June 29, from August 11 through August 30, and on a seasonally-averaged basis, compared to the Clean Crop-treated Check (Table 1). Results were similar for L1-L2 larvae from July 6 until August 3 (Table 2), and for L3-L4 larvae from July 20 through August 16 (Table 3). During early-season counts, there were more of both larval stages on plants spaced at 12" compared with those spaced at 18", but by late July the situation was reversed, and differences were usually not significant.(data not shown). The two rates of GAUCHO MZ gave better control of the potato flea beetle than did the ADMIRE treatment from June 29 through July 13 at both spacings, although all three treatments tended to be equally efficacious later in the summer and when counts were seasonally averaged (Table 4). Aphids on top, middle, and bottom leaves of plants were controlled equally well by all treatments at both spacings (data not shown), and this was observed for total aphids per plant for most August counts and for the seasonally-averaged count (Table 5). The exception was on August 25, when both rates of GAUCHO MZ controlled aphids better than ADMIRE (Table 5). Wireworm damage, assessed only on treatments 21-24, was reduced by all treatments compared to the non-insecticide-treated Check, however ADMIRE was not as efficacious as the two rates of GAUCHO MZ (Table 6). From July 28 through August 18, all treatments were equally efficacious at reducing defoliation by the Colorado potato beetle (data not shown), while on August 25 and September 1, the high rate of GAUCHO MZ gave control superior to that of the other two treatments (Table 6). Seasonally averaged, all treatments at both spacings performed equally well at reducing defoliation compared to the Check (Table 6). Row spacing did not significantly affect yields, and although there appeared to be a treatment/rate response for both total and marketable yields/ha, differences were not significant (Table 6). Because seed spacing alone resulted in no significant differences in insect populations, defoliation, or yields, data were pooled for all tables.

CONCLUSIONS: Seed spacing did not have any appreciable effect on insect populations or defoliation throughout the summer. Seed treatments of two rates of GAUCHO MZ and an at-planting application of ADMIRE in-furrow were all equally effective at reducing populations of the Colorado potato beetle relative to the fungicide-treated Check. Seasonally averaged, all treatments were equally effective at reducing aphid populations and at controlling the potato flea beetle, and all were equally efficacious at reducing plant defoliation due to the CPB throughout most of the summer. As might be expected, tuber yields in plots with seed pieces spaced at 0.5 m were lower than those from plots with seed pieces spaced at 0.3 m, but differences were not significant. Although tuber yields from treated plots were higher than those from the Checks for both seed spacings, and the higher rate of GAUCHO MZ gave the best yields, differences were not significant.

Table 1. Efficacy of two rates of GAUCHO MZ seed-piece treatment and of an in-furrow treatment of ADMIRE 240 F against Colorado potato beetle (CPB) adults on potatoes planted at two seeding rates, Harrington, PE, 2000. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB Adults/Plant[1]					
		June 29	Aug 11	Aug 18	Aug 25	Aug 30	Seas. Ave.
CLEAN CROP 8%	30	0.3a	0.9a	2.7a	3.4a	2.4a	1.0a
GAUCHO MZ 1.25%	6.3[2]	0.0b	0.1b	0.2b	0.5b	0.5b	0.1b
GAUCHO MZ 1.25%	9.4[2]	0.0b	0.1b	0.1b	0.6b	0.3b	0.1b
CLEAN CROP 8% + ADMIRE 240 F	30.0 + 1.8[2]	0.0b	0.1b	0.1b	0.9b	0.8b	0.2b
ANOVA P≤ 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

[2] g AI/100 m row.

Table 2. Efficacy of two rates of GAUCHO MZ seed-piece treatment and of an in-furrow treatment of ADMIRE 240 F against Colorado potato beetle (CPB) L1-L2 instars on potatoes planted at two seeding rates, Harrington, PE, 2000. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L1-L2 instars/ Plant[1]					
		July 06	July 13	July 20	July 27	August 03	Seas. Ave.
CLEAN CROP 8%	30	3.4a	6.5a	6.1a	2.8a	1.0a	2.1a
GAUCHO MZ 1.25%	6.3[2]	0.0b	0.0b	0.0b	0.0b	0.0b	0.2b
GAUCHO MZ 1.25%	9.4[2]	0.0b	0.0b	0.0b	0.0b	0.0b	0.1b
CLEAN CROP 8% + ADMIRE 240 F	30.0 + 1.8[2]	0.0b	0.0b	0.0b	0.0b	1.0ab	0.2b
ANOVA P≤ 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

[2] g AI/100 m row.

Table 3. Efficacy of two rates of GAUCHO MZ seed-piece treatment and of an in-furrow treatment of ADMIRE 240 F against Colorado potato beetle (CPB) L3-L4 instars on potatoes planted at two seeding rates, Harrington, PE, 2000. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L3-L4 instars/ Plant[1]					
		July 20	July 27	Aug 03	Aug 10	Aug 16	Seas. Ave.
CLEAN CROP 8%	30	7.1a	10.1a	6.0a	3.4a	1.9a	3.7a
GAUCHO MZ 1.25%	6.3[2]	0.0b	0.1b	0.1b	0.1b	0.6b	0.3b
GAUCHO MZ 1.25%	9.4[2]	0.0b	0.1b	0.0b	0.1b	0.1b	0.0b
CLEAN CROP 8% + ADMIRE 240 F	30.0 + 1.8[2]	0.0b	0.0b	0.0b	0.3b	0.2b	0.1b
ANOVA P≤ 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

[2] g AI/100 m row.

Table 4. Efficacy of two rates of GAUCHO MZ seed-piece treatment and of an in-furrow treatment of ADMIRE 240 F against potato flea beetle (PFB) adults on potatoes planted at two seeding rates, Harrington, PE, 2000. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. PFB Holes/4th Terminal Leaf[1]					
		June 29	July 06	July 13	July 20	July 27	Seas. Ave.
CLEAN CROP 8%	30	50.4a	31.8a	23.2a	67.1a	185.0a	62.3a
GAUCHO MZ 1.25%	6.3[2]	1.5c	0.4c	1.0c	20.2b	106.0ab	30.2b
GAUCHO MZ 1.25%	9.4[2]	1.9c	0.3c	0.3c	17.7b	83.2b	27.1b
CLEAN CROP 8% + ADMIRE 240 F	30.0 + 1.8[2]	12.5b	2.4b	3.7b	21.7b	95.6b	32.1b
ANOVA P≤ 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

[2] g AI/100 m row.

Table 5. Efficacy of two rates of GAUCHO MZ seed-piece treatment and of an in-furrow treatment of ADMIRE 240 F against aphids on potatoes planted at two seeding rates, Harrington, PE, 2000. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. of Aphids/Plant[1]					
		Aug 03	Aug 11	Aug 18	Aug 25	Aug 30	Seas. Avg.
CLEAN CROP 8%	30	1.5a	5.0a	7.9a	7.9a	9.9a	3.2a
GAUCHO MZ 1.25%	6.3[2]	0.0b	0.1b	1.1b	0.3c	0.8b	0.2b
GAUCHO MZ 1.25%	9.4[2]	0.3b	0.2b	0.2b	0.4c	0.5b	0.2b
CLEAN CROP 8% + ADMIRE 240 F	30.0 + 1.8[2]	0.0b	0.3b	0.8b	1.4b	0.7b	0.3b
ANOVA P≤ 0.05			s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

[2] g AI/100 m row.

Table 6. Effect of two rates of GAUCHO MZ seed-piece treatment and of an in-furrow treatment of ADMIRE 240 F on wireworm damage, CPB defoliation, and marketable tuber yield; of potatoes planted at two seeding rates, Harrington, PE, 2000. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Wireworm Damage[1]	% Defoliation[1]			Marketable Yield t/ha[1]	
		mean no. holes/ tuber	Aug. 25	Sept. 01	Seas. Avg.	0.3 m spacing	0.5 m spacing
CLEAN CROP 8%	30	1.40a	20.9a	20.9a	16.8a	30.6	26.1
GAUCHO MZ 1.25%	6.3[2]	0.07c	3.8b	3.4b	2.2b	34	31.5
GAUCHO MZ 1.25%	9.4[2]	0.05c	1.8c	1.8c	1.2b	36.5	33.3
CLEAN CROP 8% + ADMIRE 240 F	30.0 + 1.8[2]	0.21b	3.9b	3.9b	2.4b	33.4	29.6
ANOVA P≤ 0.05		s	s	s	s	ns	ns

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

[2] g AI/100 m row.

2000 PMR REPORT # 49 **SECTION C: POTATO INSECTS**
STUDY DATA BASE: 303-1251-9601

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato flea beetle (PFB), *Epitrix cucumeris* (Harris)
Aphids

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TITLE: EFFICACY OF SEVERAL FORMULATIONS AND RATES OF GAUCHO FOR INSECT CONTROL ON EARLY-SEASON POTATOES

MATERIALS: GENESIS 240 F (imidacloprid), CLEAN CROP 8% (mancozeb), MZ-GAUCHO 1.25% (imidacloprid & mancozeb), and TOPS MZ GAUCHO 1.25% ((imidacloprid, mancozeb, and TPM)

METHODS: Cut seed potato pieces were planted at Harrington, PEI, on May 18, 2000, in four-row plots with plant spacing of about 0.4 m within rows and 0.9 m between rows. Plots were arranged in a randomized complete block design with four replications. The plots measured 7.6 m in length and 3.7 m in width, and were separated from each other within each rep by two buffer rows of potatoes. All treatments consisted of pre-plant seed-piece applications and were as follows: 1) Check - CLEAN CROP 8% at 30 g AI/100 kg seed; 2) GENESIS 240 F at 6.3 g AI/100 kg seed plus CLEAN CROP 8% at 30 g AI/100 kg seed; 3) GAUCHO MZ at 6.3 g AI/100 kg seed; 4) TOPS MZ GAUCHO at 6.3 g AI/100 kg seed; and 5) GAUCHO MZ at 9.4 g AI/100 kg seed. Starting when Colorado potato beetles (CPB) first appeared in the plots, weekly counts of the numbers of CPB egg masses, adults, early-instars (L1-L2),and late-instars (L3-L4) on five whole plants per plot were done. On the same schedule, determinations of potato flea beetle (PFB) population levels were made by counting the number of holes in a fourth terminal leaf of each plant, and aphids were counted on a top, middle, and bottom leaf of the same plant. Percent defoliation in each plot was estimated each week throughout the growing season. After planting, plots received a pre-emergence application of metribuzin at 1.1 kg AI/ha for weed control. There was no need to spray the buffer rows to prevent the inter-plot movement of insects. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha, and of propamocarb at 1.6 kg AI/ha, for late blight control. Diquat was applied at the rate of 370 g AI/ha on August 24 for top desiccation. Tubers from the center two rows of each plot were harvested on 2 October and total and marketable (wt.>29 g) yields were recorded. Analyses of variance were performed on the data and Least Significant Differences (LSD) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine(prop)) before analysis. Untransformed means are presented.

RESULTS: Early-season counts of CPB adults were lower in all insecticide-treated plots, and all insecticide treatments significantly reduced numbers of CPB adults on August 8 and 14 (Table 1). The seasonal average for adults was significantly lower for all treatments in comparison with the mancozeb-treated Check (Table 1). Although on August 21 adult populations were lowest in the plots treated with the two rates of GAUCHO MZ, and counts in the GENESIS-treated plots were the same as those in the Check, overall CPB numbers were low and the differences were not significant (Table 1). All insecticides were equally efficacious at controlling L1-L2 larvae from July 04 until July 24 (Table 2), and L3-L4 larvae from July 10 to August 8 (Table 3). On July 14 and August 11 and 18, TOPS MZ GAUCHO and both rates of GAUCHO MZ appeared to more effectively limit defoliation by the Colorado potato beetle than did the GENESIS treatment, but differences were not clear-cut (Table 4). Seasonally averaged, all treatments performed equally well at reducing defoliation compared to the Check (Table 4).

Although numbers of aphids throughout August were somewhat higher in the Check than in any treated plots, there were no consistent results showing them to be efficaciously controlled by any of the treatments (data not shown). From June 26 until July 10, control of potato flea beetles was achieved by all treatments, but the trend was not sustained (Table 5). Seasonal averages show that only the high rate of GAUCHO MZ was effective at reducing PFB hole numbers below those found in the untreated Check, and this result was not statistically significant (Table 5). Tuber yields in all treated plots were significantly higher than those in the not-treated Check, with all treatments being equally efficacious. (Table 5).

CONCLUSIONS: Seed treatments of GENESIS, TOPS MZ GAUCHO, and two rates of GAUCHO MZ were all equally effective at reducing populations of the Colorado potato beetle relative to the not-treated Check. All treatments were ineffective at reducing aphid populations, and none appeared to give any sustained control of the potato flea beetle. All treatments were equally efficacious at reducing plant defoliation due to the CPB and at producing marketable tuber yields significantly greater than those in the Check plots.

Table 1. Efficacy of GENESIS, GAUCHO MZ, and TOPS MZ GAUCHO against Colorado potato beetle (CPB) adults, Harrington, PE, 2000.

Treatment (all seed-piece applications)	Rate g AI/ha	Mean No. CPB Adults/Plant[1]					
		June 29	July 04	Aug. 8	Aug. 14	Aug. 21	Seas. Ave.
CLEAN CROP 8% (CHECK)	30	0.3	0.3	3.7a	6.1a	0.4	1.2a
GENESIS 240 F (imidacloprid) plus CLEAN CROP 8%	6.3 plus 30	0.1	0	0.3b	0.1b	0.4	0.1b
GAUCHO MZ 1.25%	6.3	0.1	0	0.1b	0.2b	0.0	0.1b
TOPS MZ GAUCHO	117	0	0.1	0.1b	0.3b	1.00e -01	0.1b
GAUCHO MZ 1.25%	9.4	0	0.1	0.1b	0.1b	0.1	0.1b
ANOVA $P \leq 0.05$		ns	ns	s	s	ns	s

[1] Numbers in a column followed by the same letter are not statistically different ($P \leq 0.05$, Protected Least Significant Differences Test).

Table 2. Efficacy of GENESIS, GAUCHO MZ, and TOPS MZ GAUCHO against Colorado potato beetle (CPB) larvae (L1-L2), Harrington, PE, 2000.

Treatment (all seed-piece applications)	Rate g AI/ha	Mean No. CPB L1-L2/ Plant[1]				
		July 04	July 10	July 18	July 24	Seas. Ave.
CLEAN CROP 8% (CHECK)	30	5.9a	9.1a	16.9a	4.2a	4.3a
GENESIS 240 F (imidacloprid) plus CLEAN CROP 8%	6.3 plus 30	0.0b	0.0b	0.0b	0.0b	0.3b
GAUCHO MZ 1.25%	6.3	0.0b	0.0b	0.0b	0.0b	0.1b
TOPS MZ GAUCHO	117	0.0b	0.0b	0.0b	0.0b	0.2b
GAUCHO MZ 1.25%	9.4	0.0b	0.0b	0.0b	0.0b	0.3b
ANOVA $P \leq 0.05$		s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different ($P \leq 0.05$, Protected Least Significant Differences Test).

Table 3. Efficacy of GENESIS, GAUCHO MZ, and TOPS MZ GAUCHO against Colorado potato beetle (CPB) larvae (L3-L4), Harrington, PE, 2000.

Treatment (all seed-piece applications)	Rate g AI/ha	Mean No. CPB L3-L4/ Plant[1]					
		July 10	July 18	July 24	July 31	Aug. 08	Seas. Ave.
CLEAN CROP 8% (CHECK)	30	5.3a	17.4a	13.7a	7.9a	2.6a	6.8a
GENESIS 240 F (imidacloprid) plus CLEAN CROP 8%	6.3 plus 30	0.0b	0.0b	0.0b	0.1b	0.5b	0.2b
GAUCHO MZ 1.25%	6.3	0.0b	0.0b	0.0b	0.0b	0.2b	0.1b
TOPS MZ GAUCHO	117	0.0b	0.0b	0.0b	0.0b	0.1b	0.0b
GAUCHO MZ 1.25%	9.4	0.0b	0.0b	0.0b	0.0b	0.0b	0.0b
ANOVA $P \leq 0.05$		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different ($P \leq 0.05$, Protected Least Significant Differences Test).

Table 4. Defoliation of potato plants protected with GENESIS, GAUCHO MZ, and TOPS MZ GAUCHO, Harrington, PE, 2000.

Treatment (all seed-piece applications)	Rate g AI/ha	Defoliation (%)[1]			
		July 14	Aug 11	Aug 18	Seas. Ave.
CLEAN CROP 8% (CHECK)	30	7.0a	43.0a	43.0a	28.8a
GENESIS 240 F (imidacloprid) plus CLEAN CROP 8%	6.3 plus 30	0.1b	0.8b	0.8b	0.4b
GAUCHO MZ 1.25%	6.3	0.0c	0.5bc	0.5bc	0.3b
TOPS MZ GAUCHO	117	0.0bc	0.4bc	0.4bc	0.2b
GAUCHO MZ 1.25%	9.4	0.0c	0.1c	0.1c	0.1b
ANOVA $P \leq 0.05$		s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different ($P \leq 0.05$, Protected Least Significant Differences Test).

Table 5. Efficacy of GENESIS, GAUCHO MZ, and TOPS MZ GAUCHO against PFB damage, and yields of marketable tubers, Harrington, PE, 2000.

Treatment (all seed-piece applications)	Rate g AI/ha	Mean No. PFB Holes/Leaf[1]				Marketable Yields[1]
		June 26	July 04	July 10	Seas. Avg.	(t/ha)
CLEAN CROP 8% (CHECK)	30	63.6a	28.8a	32.3a	38	25.4b
GENESIS 240 F (imidacloprid) plus CLEAN CROP 8%	6.3 plus 30	7.4b	2.1bc	2.4c	43.8	33.3a
GAUCHO MZ 1.25%	6.3	4.7b	2.3b	7.7b	48.9	32.3a
TOPS MZ GAUCHO	117	6.1b	1.3bc	3.5bc	39.6	34.2a
GAUCHO MZ 1.25%	9.4	3.8b	1.2c	1.2c	30.8	34.8a
ANOVA $P \leq 0.05$		s	s	s	ns	s

[1] Numbers in a column followed by the same letter are not statistically different ($P \leq 0.05$, Protected Least Significant Differences Test).

2000 PMR REPORT # 50 **SECTION C: POTATO INSECTS**
STUDY DATA BASE: 303-1251-9601

CROP: Potato, cv. Shepody
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato flea beetle (PFB), *Epitrix cucumeris* (Harris)
Tarnished plant bug (TPB), *Lygus lineolaris* (P. De Beauvois)
Aphids

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TITLE: COMPARISON OF ACTARA AND THIAMETHOXAM WITH ADMIRE FOR CONTROL OF INSECTS IN POTATOES

MATERIALS: ACTARA 25 WG (thiomethoxam), thiamethoxam 240 SC, ADMIRE 240 FS (imidacloprid)

METHODS: Small, whole seed potatoes were planted at Harrington, PEI, on May 23, 2000. Plants were established in four-row plots and spaced at about 0.4 m within rows and 0.9 m between rows, and there were four replications. The plots, measuring 7.6 m in length and 3.7 m in width, were separated from each other within each rep by two buffer rows of potatoes. Plots were arranged in a randomized complete block design, with the following six treatments: 1) Not-treated Check; 2) foliar applications of ACTARA 25 WG at 26 g AI/ha on July 5 and August 25, 2000; 3) in-furrow application of thiamethoxam 240 SC at 91 g AI/ha at planting; 4) in-furrow application of thiamethoxam 240 SC at 117 g AI/ha at planting; 5) foliar applications of ADMIRE 240 F at 48 g AI/ha on July 5, July 26, and August 25, 2000; and 6) in-furrow application of ADMIRE 240 F at 204 g AI/ha at planting. Foliar applications were made using a CO_2-pressurized precision plot sprayer that delivered a final spray volume of 250 L H_2O/ha at 240 kPa. Initial foliar treatments were applied on July 5, upon hatch of 30% of the Colorado potato beetle egg masses being monitored in the Check plots, and the subsequent applications were made when a threshold of 1.0 CPBE (Colorado Potato Beetle Equivalents)/plant was reached or exceeded in each treatment. The multiplication of CPB spring adults by 1.0, L1-L2 larvae by 0.125, L3-L4 larvae by 0.333, or summer adults by 0.625 converts each growth stage to its CPBE. The in-furrow treatments were applied in a 15 cm band using a backpack sprayer that delivered a final spray volume of 1.6L/100 metres at 276 kPa. Counts of the numbers of tarnished plant bugs, and of Colorado potato beetle egg masses, adults, early-instars (L1-L2), and late-instars (L3-L4) on 10 whole plants per plot were done at 1 day pre-spray (July 4) and 3, 7, 14, 21, 28, and 35 days post-spray for the July 5 and 26 sprays, and at 3, 7 , and 13 days post-spray for the August 25 spray. On the same schedule, potato flea beetle populations were assessed by counting the numbers of PFB holes in a fourth terminal leaf of each of the ten plants, and aphids were counted on a top, middle, and bottom leaf of the same plants. Percent defoliation by the CPB in each plot was estimated each week throughout the growing season. After planting, plots received a pre-emergence application of metribuzin at 1.1 kg AI/ha for weed control. There was no need to spray the buffer rows to prevent the inter-plot movement of insects. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha, and of propamocarb at 1.6 kg AI/ha, for late blight control. Diquat was applied at the rate of 370 g AI/ha on September 25 for top desiccation. Tubers from the center two rows of each plot were harvested on 2 October and marketable (wt.>33 g) yields were recorded. Analyses of variance were performed on the data and Least Significant Differences (LSD) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine(prop)) before analysis. Untransformed means are presented.

RESULTS: The seasonal average number of CPB adults was significantly lower for the ACTARA, the ADMIRE, and both thiamethoxam treatments in comparison with the not-treated Check (Table 1). Based on seasonal averages, two foliar applications of ACTARA gave significantly better adult control than did either three foliar applications of ADMIRE or the ADMIRE in-furrow treatment (Table 1). All products tested reduced L1-L2 instars from July 12-28 (Table 2), and L3-L4 instars from July 19-August 9 (Table 3). The foliar applications of ACTARA and ADMIRE, and the in-furrow applications of ADMIRE and both rates of thiamethoxam, reduced defoliation by the Colorado potato beetle season-long relative to the Not-treated Check, and, seasonally averaged, all in-furrow treatments resulted in significantly less defoliation than did either foliar spray (Table 4). All products were efficacious at reducing the seasonal average total number of aphids (Table 5), but there were no consistent results showing efficacy of any of the treatments for sustained control of potato flea beetles or tarnished plant bugs (data not shown). Although both total and marketable tuber yields in all treated plots were higher than those in the not-treated Check, differences were not statistically significant (Table 5).

CONCLUSIONS: In-furrow applications of thiamethoxam at 91 and 117 g AI/ha or of ADMIRE at 204 g AI/ha, and foliar applications of ACTARA at 26 g AI/ha and ADMIRE at 48 g AI/ha, reduced populations of the Colorado potato beetle relative to the not-treated Check. Two applications of foliar ACTARA were more efficacious at reducing numbers of CPB adults than were three of foliar ADMIRE or the ADMIRE in-furrow treatment. All treatments reduced aphid populations, but did not give consistent control of the potato flea beetle or the tarnished plant bug. Defoliation by the Colorado potato beetle was reduced by all treatments in comparison with the not-treated Check, with the in-furrow applications being somewhat more effective than the foliar applications.

Table 1. Efficacy of ACTARA 25 WG, ADMIRE, and two rates of thiamethoxam applied in-furrow, against Colorado potato beetle (CPB) adults, Harrington, PE, 2000.

Treatment	Rate g AI/ha	Mean No. CPB Adults/Plant[1]			
		Aug. 9	Aug. 15	Aug. 23	Seas. Ave.
CHECK	-	0.3a	1.9a	4.5a	1.3a
ACTARA 25 WG Foliar	26	0.1b	0.0b	0.7b	0.2c
thiamethoxam 240 SC In-furrow	91	0.0b	0.1b	0.5b	0.3bc
thiamethoxam 240 SC In-furrow	117	0.0b	0.1b	0.3b	0.6bc
ADMIRE 240 F Foliar	48	0.0b	0.2b	1.5b	0.7b
ADMIRE 240 F In-furrow	204	0.1ab	0.1b	0.6b	0.6b
ANOVA $P \leq 0.05$		s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different ($P \leq 0.05$, Protected Least Significant Differences Test).

Table 2. Efficacy of ACTARA 25 WG, ADMIRE, and two rates of thiamethoxam applied in–furrow, against Colorado potato beetle (CPB) larvae (L1-L2), Harrington, PE, 2000.

Treatment	Rate g AI/ha	Mean No. CPB L1-L2/ Plant[1]				
		July 12	July 19	July 26	July 28	Seas. Ave.
CHECK	-	12.0a	16.0a	4.7a	3.8a	4.0a
ACTARA 25 WG Foliar	26	0.1b	0.8bc	0.6bc	0.1b	0.8bc
thiamethoxam 240 SC In-furrow	91	0.0b	0.0c	0.5c	0.8b	0.5cd
thiamethoxam 240 SC In-furrow	117	0.6b	0.0c	0.0c	0.0b	0.1d
ADMIRE 240 F Foliar	48	4.6a	2.3b	2.5ab	0.8b	1.7b
ADMIRE 240 F In-furrow	204	0.0b	0.0c	0.0c	0.0b	0.5cd
ANOVA $P \leq 0.05$		s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different ($P \leq 0.05$, Protected Least Significant Differences Test).

Table 3. Efficacy of ACTARA 25 WG, ADMIRE, and two rates of thiamethoxam applied in-furrow, against Colorado potato beetle (CPB) larvae (L3-L4), Harrington, PE, 2000.

Treatment	Rate g AI/ha	Mean No. CPB L3-L4/ Plant[1]					
		July 19	July 26	July 28	Aug. 02	Aug. 09	Seas. Ave.
CHECK	-	7.7a	10.0a	10.0a	8.2a	3.8a	3.9a
ACTARA 25 WG Foliar	26	0.2b	0.7c	0.8b	0.6b	0.7b	0.6b
thiamethoxam 240 SC In-furrow	91	0.0b	0.1c	0.0c	0.0b	0.0b	0.2bc
thiamethoxam 240 SC In-furrow	117	0.0b	0.0c	0.0c	0.0b	0.0b	0.0c
ADMIRE 240 F Foliar	48	0.5b	3.0b	0.4bc	0.2b	0.1b	0.5b
ADMIRE 240 F In-furrow	204	0.0b	0.0c	0.1bc	0.0b	0.5b	0.3bc
ANOVA P≤ 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

Table 4. Defoliation of potato plants protected with ACTARA 25 WG, ADMIRE, and two rates of thiamethoxam applied in-furrow, Harrington, PE, 2000.

Treatment	Rate g AI/ha	Defoliation (%)[1]					
		July 14	July 21	Aug. 18	Sept. 1	Sept 8	Seas. Ave.
CHECK	-	6.0a	13.5a	15.8a	39.5a	60.5a	23.1a
ACTARA 25 WG Foliar	26	5.0a	5.0b	3.6b	9.0b	14.0b	5.7b
thiamethoxam 240 SC I .- F.	91	0.5b	0.1c	0.7c	3.5cd	11.5b	2.5c
thiamethoxam 240 SC I. - F.	117	0.0b	0.0c	0.3c	2.0d	11.0b	1.8c
ADMIRE 240 F Foliar	48	4.3a	4.3b	2.4bc	7.5bc	20.5b	6.0b
ADMIRE 240 F In-furrow	204	0.3b	0.4c	1.3bc	6.0bc	17.0b	3.7c
ANOVA P≤ 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

Table 5. Efficacy of ACTARA 25 WG, ADMIRE, and thiamethoxam applied in-furrow, against aphids, and total and marketable tuber yields, Harrington, PE, 2000.

Treatment	Rate g AI/ha	Mean No. Aphids/Plant[1]	Yield (t/ha)[1]	
		Seas. Avg.	total	marketable
CHECK	-	3.2a	31.9	31.85
ACTARA 25 WG Foliar	26	0.7b	35.1	34.8
thiamethoxam 240 SC I .- F.	91	0.1cd	35.3	35.1
thiamethoxam 240 SC I. - F.	117	0.1d	37.9	37.7
ADMIRE 240 F Foliar	48	0.4bc	35.1	34.9
ADMIRE 240 F In-furrow	204	0.4bcd	35.6	35.4
ANOVA P≤ 0.05		s	ns	ns

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected Least Significant Differences Test).

2000 PMR REPORT # 51 **SECTION C: POTATO INSECTS**
STUDY DATA BASE: 280-1252-9904

CROP: Potato, cv. Yukon Gold (Site I); cv. Chieftain (Sites II, III)
PEST: Eastern Field Wireworm (WW), *Limonius agonus* (Say)

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TITLE: FURROW APPLICATION OF CONTROL AGENTS FOR CONTROL OF DAMAGE TO POTATO BY FIELD WIREWORMS, 2000

MATERIALS: ADMIRE 240 F (imidacloprid), ACTARA 240 SC (thiamethoxam), BOTANIGARD (*Beauveria bassiana*)(2.1 x 10^{13} viable spores/L), CANON 200 SC (fipronil), THIMET 15 G (phorate), WARRIOR T (ë-cyhalothin)

METHODS: Freshly cut potato seed pieces were hand-planted in single row plots (20 seed pieces/4 m) in sandy loam soil on: Lot 5, III Concession, London Township, Middlesex County on May 17 (Site I); Lot 21, II Concession, Mulmur Township, Dufferin County on May 26 (Site II); and, Lot 11, II Concession, Melancthon Township, Dufferin County on June 02 (Site III). At each site, all treatments were replicated 4 times in a randomized complete block design. The furrow-granular treatment (Tmt. 9) was hand-applied in a 5-7 cm band on top of the seed pieces before the seed furrow was closed. Furrow-spray treatments (Tmts. 1-8) were applied in a 5-7 cm band over seed pieces in the bottom of the planting furrow, using a hand-held, CO_2-pressurized, single-nozzled (6506 flat fan) R&D plot sprayer, at 200 kPa in 5 L water/100 m row. On August 23 (Site I) and 29 (Sites II, III) potatoes were dug by hand; guard plants at either row end were not harvested. All potatoes from each plot were bagged and returned to the laboratory for grading. Each potato was graded according to the scale: light - 1-2 holes/tuber with total tunnel length < 12.5 mm; moderate - > 2 feeding holes, none > 12.5 mm and total tunnel length < 19 mm; severe - trim required to remove WW-damage > 5% of total weight of tuber. For the purposes of analysis, the number of potatoes in all damage categories in each plot were summed and the total % damaged potatoes recorded. % WW-Damage for each plot was subjected to arcsin square root transformation prior to statistical analysis by analysis of variance; Student-Neuman-Keul's Multiple Range Test was used to estimate significance of differences among treatment means.

RESULTS: Experimental results are outlined in Table 1. No phytotoxicity was observed following any in-furrow treatment. WW-damage in untreated plots at Sites I and III was < 10%. At Site II an average of just over 20% of potatoes in untreated plots showed WW-feeding scars. WW-damage was also unevenly distributed at all sites resulting in high variability amongst replicate blocks. Nevertheless at Site II, in-furrow application of CANON resulted in a significant reduction in the % WW-damage to harvested tubers. While WW-damage was lower following in-furrow application of the commercial standard, THIMET 15G, the decrease was not significant. At Sites I and II WW-damage was too low to distinguish amongst efficacy of tested treatments.

CONCLUSION: In-furrow spray application of CANON significantly reduced WW-damage to harvested potato tubers in the only trial where damage in untreated plots exceeded 10%.

Table 1: Impact of furrow application of control agents on damage to potato by wireworms, 2000.

Tmt No.	Insecticide Applied	Rate Applied (Pdct./ 100 m)	Mean % Wireworm Damage at Indicated Site		
			I	II	III
1.	CANON 200SC	12.5 ml	4.9 a[1]	2.9 a	2.6 a
2.	ACTARA 240SC	4.5ml	7.3 a	15.4 b	4.9 a
3.	ACTARA 240SC + BOTANIGARD	4.5 ml + 35.0 ml	8.1 a	25.0 b	5.1 a
4.	ACTARA 240SC + BOTANIGARD	4.5 ml + 20.0 ml	8.1 a	24.7 b	4.5 a
5.	ADMIRE 240F	15.0 ml	6.2 a	26.1 b	12.3 a
6.	ADMIRE 240F + BOTANIGARD	15.0 ml + 35.0 ml	8.8 a	24.8 b	6.7 a
7.	BOTANIGARD	35.0 ml	7.3 a	23.5 b	4.1 a
8.	WARRIOR T	2.0 ml	6.7 a	14.7 b	6.7 a
9.	THIMET 15G	215.0 g	6.5 a	11.7 b	3.7 a
10.	CONTROL[2]	----	3.4 a	20.6 b	7.3 a

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using Student-Neuman-Keul's Multiple Range Test.

[2] no insecticide.

2000 PMR REPORT # 52 **SECTION C: POTATO INSECTS**
STUDY DATA BASE: 280-1252-9904

CROP: Potato, cv. Yukon Gold
PEST: Potato leafhopper (PLH), *Empoasca fabae* (Harris)

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TITLE: FURROW APPLICATION OF CONTROL AGENTS FOR CONTROL OF DAMAGE TO POTATO FOLIAGE BY POTATO LEAFHOPPER, 2000

MATERIALS: ADMIRE 240 F (imidacloprid), ACTARA 240 SC (thiamethoxam), BOTANIGARD (*Beauveria bassiana*)(2.1 x 10^{13} viable spores/L), CANON 200 SC (fipronil), THIMET 15 G (phorate), WARRIOR T (ē-cyhalothin)

METHODS: Freshly cut potato seed pieces were hand-planted in single row plots (20 seed pieces/4 m) in sandy loam soil on Lot 5, III Concession, London Township, on May 17. All treatments were replicated 4 times in a randomized complete block design. The furrow-granular treatment (Tmt. 9) was hand-applied in a 5-7 cm band on top of the seed pieces before the seed furrow was closed. Furrow-spray treatments (Tmts. 1-8) were applied in a 5-7 cm band over seed pieces in the bottom of the planting furrow, using a hand-held, CO_2-pressurized, single-nozzled (6506 flat fan) R&D plot sprayer, at 200 kPa in 5 L water/100 m row. On July 20, 28 and August 11, a total of 10 randomly selected, terminal leaflets in each plot were rated for PLH damage on a 0 - 2 scale assigned as follows: 0 - no symptoms of PLH feeding; 1 - leaf-curling only; 2 - leaf-curling + necrosis and/or brown leaf margins around at least part of the leaflet. On each date a Cumulative PLH-Rating was then calculated for each plot by summing individual leaf-ratings for that plot. Statistical significance of observed impact of furrow application on PLH-damage to potato foliage was determined by analysis of variance. Significance of differences among treatments means was determined using Student-Neuman-Keul's Multiple Range Test.

RESULTS: Experimental results are outlined in Table 1. No phytotoxicity was observed following any in-furrow treatment. Damaging PLH-populations did not develop in the experimental block until the middle of July. By July 20, over 9 weeks after planting, pronounced leaf curling was observed in untreated plots (Tmt. 10) and in plots treated with CANON (Tmt. 1), WARRIOR T (Tmt. 8) or BOTANIGARD alone (Tmt. 7). Slightly less injury was recorded at that time in plots receiving furrow-application of ADMIRE (Tmt. 5) or ADMIRE + BOTANIGARD (Tmt. 6). Significantly less damage was recorded in plots treated with THIMET (Tmt. 9), ACTARA (Tmt. 2) or combinations of ACTARA with BOTANIGARD (Tmts. 3, 4); most leaves in those plots showed no signs of PLH-feeding. By August 11, just over 12 weeks post planting, leaf-curling plus dead leaf margins were recorded in almost all examined terminal leaflets in untreated plots as well as in plots treated with CANON, WARRIOR T or BOTANIGARD alone. On that date, while leaf curling was noted for most sampled leaflets, the mean Cumulative PLH-Rating for remaining treatments was significantly lower.

CONCLUSIONS: THIMET and the neonicotinyl insecticides ADMIRE and ACTARA provided effective systemic protection of potato foliage for over 9 weeks. Reduced PLH-damage to foliage in plots treated with these treatments was observed for 12 weeks. Addition of the fungus, *Beauveria bassiana* (BOTANIGARD) to the neonicotinyl insecticides did not affect protection against PLH by these insecticides. BOTANIGARD alone did not reduce PLH-damage to potato foliage. Neither CANON nor WARRIOR T exhibited any systemic protection of potato foliage; furrow application of neither insecticide reduced the recorded Cumulative PLH-Rating in treated plots.

Table 1: Impact of furrow application of control agents on damage to potato foliage by the potato leafhopper, *Empoasca fabae*, 2000.

Tmt No.	Insecticide Applied	Rate Applied (Pdct./ 100 m)	Mean Cumulative PLH-Rating[1] on Indicated Date		
			20 Jul	28 Jul	11 Aug
1	CANON 200SC	12.5 ml	12.0 a	13.3 ab	19.0 a
2	ACTARA 240SC	4.5ml	3.8 c	5.0 c	9.8 c
3	ACTARA 240SC + BOTANIGARD	4.5 ml + 35.0 ml	2.8 c	6.8 c	10.0 c
4	ACTARA 240SC + BOTANIGARD	4.5 ml + 20.0 ml	4.3 c	5.5 c	11.0 bc
5	ADMIRE 240F	15.0 ml	6.5 bc	9.3 bc	14.5 b
6	ADMIRE 240F + BOTANIGARD	15.0 ml + 35.0 ml	7.0 bc	7.3 c	13.0 bc
7	BOTANIGARD	35.0 ml	12.0 a	15.3 ab	18.3 a
8	WARRIOR T	2.0 ml	12.3 a	16.3 a	18.8 a
9	THIMET 15G	215.0 g	5.5 c	9.5 bc	12.8 bc
10	CONTROL[3]	-----	10.0 ab	14.5 ab	18.8 a

[1] 0 - 2 scale assigned as follows: 0 - no symptoms of PLH feeding; 1 - leaf-curling only; 2 - leaf-curling + necrosis and/or brown leaf margins around at least part of the leaflet. Cumulative rating is sum of ratings for all 10 leaves selected from each plot.

[2] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using Student-Neuman-Keul's Multiple Range Test.

[3] no insecticide.

END OF SECTION C - POTATO INSECTS
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SECTION D: **MEDICAL and VETERINARY/MÉDICAL et VÉTÉRINAIRE**

REPORT/RAPPORT #: **No reports**

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SECTION E: **CEREAL, FORAGE and OILSEED CROPS /CÉRÉALES, CULTURES FOURRAGÈRES et OLÉAGINEUX**

REPORT/RAPPORT #: **53 - 61**

PAGES: **127 -**

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2000 PMR REPORT # 53 **SECTION E: INSECT PESTS OF CEREAL, FORAGE, AND OILSEED CROPS**

ICAR: 61006537

CROP: Beans, *Phaseolus vulgaris* L.; SW3308 soybeans, *Glycine max* (L.) Merr.; Stingray white beans; Montcalm Dark Red kidney beans

PEST: Seed corn maggot, *Delia platura*

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TITLE: CONTROL OF SEED CORN MAGGOT WITH SEED TREATMENTS

MATERIALS: VITAFLO 280 (thiram + carbathiin, 148 + 167 g ai/L); MAXIM 480 (fludioxonil, 480 g ai/L); APRON XL (metalaxyl-m, 369 g ai./L); AGROX DL Plus (lindane + captan + diazinon, 25% + 15% + 15% w/w); CRUISER 600 FS (thiamethoxam, 600 g ai/L); DCT (diazinon + captan + thiophanate methyl, 18% + 6% + 14%); KERNEL GUARD SUPREME (permethrin + carboxin, 10.4% + 14.0 % w/w); L1022-A1 600 FS (imidacloprid, 600 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying the treatment or slurry (all treatments diluted to the same volume of 3.1 ml/kg seed using water) via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. The crop was planted on 15 May, 2000 at Ridgetown using a 2-row cone seeder at 100 seeds per plot. Plots were 1 row planted at a row spacing of 0.76 m and 6 m in length placed in a randomized complete block design with 4 replications. Manure was placed on the plots 1 week prior to planting and the soil was worked shortly after the manure application. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence was evaluated on 3 and 5 June, 2000 respectively. Vigor was assessed using a scale of 1-10 (10= most advanced plant and 1 = 10% development of the most advanced plant) on 3 and 5 June, 2000 respectively. Seed corn maggot damage and number of maggots was assessed 21 DAP on 5 June, 200 by exhuming a 1 m length of row. All seeds within the 1 m were counted, whether they had emerged or not and checked for seed corn maggot damage.

RESULTS: See Tables 1, 2 & 3.

CONCLUSIONS: In soybeans none of the treatments exceeded the performance of the standard - AGROX DL Plus, but several were equivalent. In white and kidney beans none of the treatments exceeded the full rate of DCT in performance, but several were equivalent.

Table 1. Control of seed corn maggot in soybeans with seed treatments at Ridgetown, Ontario. 2000.

Treatment	Rate ml or g/kg	% Emerg 10 m 3-6-00	Vigor 1-10 10 m 3-6-00	% Emerg 10 m 5-6-00	Vigor 1-10 10 m 5-6-00	Plants % Damage 5-6-00	Seed corn maggot # /m
Non-treated		29 e [1]	2.8 c	30 d	3.3 c	60 ab	9
L1022-A1	3.1 ml	31 e	2.8 c	33 d	3.3 c	65 a	8
L1022-A1 +KERNEL GUARD SUPREME	3.1 ml + 2.42 g	52 bc	5.5 bc	50 bc	6.0 abc	48 ab	5.8
VITAFLO 280	2.6 ml	30 e	3.5 c	31 d	3.0 c	64 ab	16
VITAFLO 280 +AGROX DL Plus	2.6 ml + 2 g	68 a	6.8 ab	68 a	6.3 abc	45 ab	3.8
DCT	10.4 ml	50 cd	5.3 bc	49 bc	4.8 bc	51 ab	3.8
MAXIM +APRON XL	0.05 ml + 0.1 ml	37 de	3.5 c	37 cd	4.3 bc	64 ab	6
MAXIM +APRON XL +CRUISER	0.05 ml + 0.1 ml +0.43 ml	65 ab	7.5 ab	64 ab	7.3 ab	46 ab	4.5
MAXIM +APRON XL +CRUISER	0.05 ml + 0.1 ml +0.86 ml	76 a	8.8 a	76 a	8.5 a	43 bc	4.8
MAXIM +APRON XL +AGROX DL Plus	0.05 ml + 0.1 ml + 2 g	77 a	8.8 a	78 a	8.5 a	23 c	2
LSD (P=.05)		14.7	3.2	16.2	3.6	21.1	NS
CV		19.4	39.9	21.7	45.4	28.7	101.8

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Control of seed corn maggot in white beans with seed treatments at Ridgetown, Ontario. 2000.

Treatment	Rate ml or g/kg	% Emerg 10 m 3-6-00	Vigor 1-10 10 m 3-6-00	% Emerg 10 m 5-6-00	Vigor 1-10 10 m 5-6-00	Plants % Damage 5-6-00	Seed corn maggot # /m
Non-treated		4.5 f [1]	1.0 e	8.5 f	1.0 e	46	1.8
L1022-A1	3.1 ml	32.8 cd	5.5 bc	41.5 d	3.5 cd	54	6.8
L1022-A1 +KERNEL GUARD SUPREME	3.1 ml + 2.42 g	27.8 de	5.8 bc	37.8 de	4.5 bcd	66	5.3
VITAFLO 280	2.6 ml	15.8 ef	2.3 de	25.0 e	2.3 de	65	17.8
VITAFLO 280 +AGROX DL plus	2.6 ml + 2 g	32.0 ab	4.5 cd	59.0 bc	6.0 b	45	2
DCT	10.4 ml	48.5 ab	7.8 ab	74.3 a	8.5 a	49	3.5
MAXIM +APRON XL	0.05 ml + 0.1 ml	39.8bcd	5.8 bc	50.3 cd	5.3 bc	50	8
MAXIM +APRON XL +CRUISER	0.05 ml + 0.1 ml +0.43 ml	41.3abc	7.0 abc	57.8 bc	6.8 ab	46	2
MAXIM +APRON XL +CRUISER	0.05 ml + 0.1 ml +0.86 ml	53.0 a	9.0 a	71.8 ab	8.8 a	52	8.8
MAXIM +APRON XL +AGROX DL plus	0.05 ml + 0.1 ml + 2 g	48.5 ab	6.5 abc	85.3 a	8.5 a	33	2.3
LSD (P=.05) [1]		13.2	3.1	14.1	2.3	NS	NS
CV		26.5	38.3	18.9	28.2	35.4	163.1

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 3. Control of seed corn maggot in kidney beans with seed treatments at Ridgetown, Ontario. 2000.

Treatment	Rate ml or g/kg	% Emerg 10 m 3-6-00	Vigor 1-10 10 m 3-6-00	% Emerg 10 m 5-6-00	Vigor 1-10 10 m 5-6-00	Plants % Damage 5-6-00	Seed corn maggot # /m
Non-treated		22 d[1]	2.8 e	33 d	4.3	56 ab	0.8
L1022-A1	3.1 ml	25 cd	3.0 e	34 d	3.8	60 a	0.8
L1022-A1 + KERNEL GUARD SUPREME	3.1 ml + 2.42 g	32 bcd	6.5 a-d	46 cd	4.5	52 abc	2.3
VITAFLO 280	2.6 ml	25 cd	5.3 b-e	38 cd	5	49 abc	1.3
VITAFLO 280 + AGROX DL plus	2.6 ml + 2 g	32 bcd	3.3 de	62 ab	4	36 cde	0
DCT	10.4 ml	50 a	8.5 ab	76 a	7.5	28 de	0.5
MAXIM + APRON XL	0.05 ml + 0.1 ml	25 cd	4.3 cde	39 cd	4.3	56 ab	2.5
MAXIM + APRON XL + CRUISER	0.05 ml + 0.1 ml +0.43 ml	31 bcd	5.5 a-e	49 bc	6.8	65 a	2.5
MAXIM + APRON XL + CRUISER	0.05 ml + 0.1 ml +0.86 ml	36 bc	7.3 abc	69 a	7.5	40 bcd	1.3
MAXIM + APRON XL + AGROX DL plus	0.05 ml + 0.1 ml + 2 g	39 ab	808 a	72 a	7.5	23 e	0.3
LSD (P=.05)[1]		11.4	3.5	14.4	4.3	16.4	NS
CV		25.1	43.4	19.3	53.9	24.3	107

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[1] Means followed by same letter do not significantly differ (P=.05, LSD).

2000 PMR REPORT # 54 **SECTION E: INSECT PESTS OF CEREAL, FORAGE, and OILSEED CROPS**
ICAR: 61006537

CROP: Edible beans, *Phaseolus vulgaris* L., cv. Stingray white bean, OAC Thunder white bean, SVM Taylor Cranberry bean, Montcalm Dark Red Kidney bean
PEST: Potato Leaf Hopper, *Empoasca fabae*

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TITLE: CONTROL OF POTATO LEAF HOPPER IN DRY EDIBLE BEANS WITH SEED TREATMENTS

MATERIALS: CYGON® 480 E (dimethoate 480 g ai/L); APRON XL 369 LS (metalaxyl-m, 369 g ai/L); MAXIM 480 FS (fludioxonil 480 g ai/L); CRUISER 350 FS (thiamethoxam 350 g ai/L); DCT (diazinon + captan + thiophanate methyl, 18% + 6% + 14% w/w); G7009 600 (600 g ai/L); GAUCHO 600 FS (imidacloprid 600 g ai/L).

METHOD: Seed was treated in 1 kg lots in individual bags by applying the material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. Beans were planted on 22 June, 2000 at a seeding rate of 15 seeds/m using a two-row cone seeder mounted on a John Deere Max Emerge planter. Plots were 2 row, spaced 0.76 m apart and 6 m in length arranged in RCBD with 4 reps. Blocks of highly susceptible Berna were planted between each bean type. The plots were fertilized and maintained according to provincial recommendations. Emergence counts were taken on 5 July, 2000. Cygon was applied as the Treated Check every week dependent on plots reaching nymph threshold stages, where Stage 1 = unifoliate leaf with average 0.25 nymphs per leaf; Stage 2 = up to 2nd unifoliate leaf with average 0.5 nymphs per trifoliate leaf (or 1.0 nymph for 2 trifoliate leaves); Stage 3 = 2nd trifoliate to 4th trifoliate leaf with average 1.0 nymphs per trifoliate leaf; Stage 4 = 4th trifoliate leaf to bloom with average 2.0 nymphs per trifoliate leaf. Cygon was applied at 1 L product per ha using a Solo Backpack sprayer with a single 8002VS TEEJET nozzle at a rate of 30 psi at 186 L/ha. Leaf hopper samples were counted over several weeks, sampling the uppermost fully expanded leaf on 10 plants per plot. The leaf was removed from the plant and the number of leafhopper nymphs on the underside and top of each leaf was recorded.

RESULTS: See Tables 1, 2, 3, 4, and 5.

CONCLUSIONS: CRUISER reduced nymph counts for up to 5 weeks after planting.

Table 1. Emergence counts in edible beans at Ridgetown, Ontario on 5 July, 2000.

Treatment	Rate g ai/kg seed	Stingray %Emergence	OAC Thunder %Emergence	Kidney %Emergence	Cranberry %Emergence
CHECK		83 b [1]	77 cd	78	73 cd
TREATED CHECK CYGON (Foliar Spray	 480 g ai/ha	82 b	78 cd	88	77 bc
APRON XL +MAXIM	0.037 g 0.025 g	92 a	83 a-d	83	71 d
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 0.50 g	94 a	94 a	84	80 ab
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 1.0 g	95 a	81 bcd	89	83 a
DCT	5.2 g	93 a	88 abc	82	80 ab
G7009	0.25 g	90 ab	87 abc	86	81 ab
G7009	0.50 g	89 ab	90 ab	85	82 ab
GAUCHO	0.25 g	88 ab	80 bcd	79	81 ab
GAUCHO	0.50 g	92 a	76 d	80	79 abc
LSD (P=.05)		8.3	11.2	NS	6
CV		6.4	9.3	7.4	5.3

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Nymph counts on Stingray white beans at Ridgetown, Ontario. 2000.

Treatment	Rate g ai/kg seed	Nymphs per trifoliate 2 Trif 11-7-00	3-4 Trif 20-7-00	6 Trif 27-7-00	Early Flower 8-8-00	Mid Pod 14-8-00
UNTREATED CHECK		0.6 a[1]	0.5 bc	0.5	0.1	0
TREATED CHECK CYGON(foliar spray)	 480 g ai/ha	0.3 abc	0.2 cde	0.3	0.1	0
APRON XL +MAXIM	0.037 g 0.025 g	0.5 a	0.4 bcd	0.4	0	0
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 0.50 g	0.1 bc	0.1 de	0.1	0.1	0.1
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 1.0 g	0.0 c	0.0 e	0.1	0.1	0.1
DCT	5.2 g	0.4 ab	0.6 b	0.4	0	0
G7009	0.25 g	0.1 bc	0.1 e	0.7	0	0.1
G7009	0.50 g	0.0 c	0.2 cde	0.2	0.1	0.1
GAUCHO	0.25 g	0.0 c	1.2 a	0.6	0.2	0
GAUCHO	0.50 g	0.0 c	0.2 cde	0.4	0.1	0
LSD (P=.05)		0.3	0.4	NS	NS	NS
CV		122.1	72.5	116.5	136.3	191.7

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 3. Nymph counts on OAC Thunder white beans at Ridgetown, Ontario. 2000

		Nymphs per trifoliate				
Treatment	Rate g ai/kg seed	2 Trif 11-7-00	3-4 Trif 20-7-00	6 Trif 27-7-00	Early Flower 8-8-00	Mid Pod 14-8-00
UNTREATED CHECK		0.3	0.3	0.2	0.1	0
TREATED CHECK CYGON (foliar spray)	480 g ai/ha	0.4	0.2	0.2	0	0
APRON XL +MAXIM	0.037 g 0.025 g	0.2	0.2	0.2	0.1	0
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 0.50 g	0.1	0.1	0.1	0	0
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 1.0 g	0.1	0.1	0.1	0	0
DCT	5.2 g	0.2	0.3	0.3	0	0
G7009	0.25 g	0	0.1	0.1	0	0
G7009	0.50 g	0	0	0	0.1	0
GAUCHO	0.25 g	0	0.3	0.2	0	0.1
GAUCHO	0.50 g	0.1	0.1	0.3	0	0.1
LSD (P=.05)		NS	NS	NS	NS	NS
CV		143.2	95	89.1	148	366.8

Table 4. Nymph counts on Dark Red Kidney beans at Ridgetown, Ontario. 2000.

		Nymphs per trifoliate				
Treatment	Rate g ai/kg seed	2 Trif 11-7-00	3-4 Trif 20-7-00	6 Trif 27-7-00	Early Flower 8-8-00	Mid Pod 14-8-00
UNTREATED CHECK		0.3	0.8 a [1]	0.9 a	0.1	0
TREATED CHECK CYGON (foliar spray)	480 g ai/ha	0.2	0.7 a	0.8 a	0.1	0
APRON XL +MAXIM	0.037 g 0.025 g	0.4	0.9 a	0.9 a	0.1	0
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 0.50 g	0.1	0.1 bc	0.2 bc	0	0
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 1.0 g	0.1	0.0 c	0.1 c	0.2	0
DCT	5.2 g	0.6	0.8 a	0.6 ab	0	0
G7009	0.25 g	0.2	0.2 bc	0.3 bc	0	0
G7009	0.50 g	0.1	0.0 c	0.2 c	0	0
GAUCHO	0.25 g	0.1	0.3 bc	0.3 bc	0.1	0
GAUCHO	0.50 g	0.2	0.4 b	0.3 bc	0	0.1
LSD (P=.05		NS	0.3	0.4	NS	NS
CV		97.5	57	61.7	224.4	227.1

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 5. Nymph counts on Cranberry beans at Ridgetown, Ontario. 2000.

		Nymphs per trifoliate				
Treatment	Rate g ai/kg seed	2 Trif 11-7-00	3-4 Trif 20-7-00	6 Trif 27-7-00	Early Flower 8-8-00	Mid Pod 14-8-00
UNTREATED CHECK		0.5	0.6 a [1]	0.5 a	0.2	0.1
TREATED CHECK CYGON (foliar spray)	480 g ai/ha	0.3	0.4 ab	0.0 b	0.1	0
APRON XL +MAXIM	0.037 g 0.025 g	0.1	0.5 a	0.6 a	0.2	0
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 0.50 g	0	0.0 c	0.0 b	0.3	0.1
APRON XL +MAXIM +CRUISER	0.037 g 0.025 g 1.0 g	0.1	0.0 c	0.1 b	0.1	0.1
DCT	5.2 g	0.1	0.5 a	0.7 a	0.2	0
G7009	0.25 g	0.1	0.0 c	0.1 b	0.3	0.1
G7009	0.50 g	0.1	0.0 c	0.2 b	0.4	0
GAUCHO	0.25 g	0	0.4 ab	0.6 a	0.2	0
GAUCHO	0.50 g	0.2	0.2 bc	0.5 a	0.3	0
LSD (P=.05)		NS	0.3	0.4	NS	NS
CV		204.5	78.7	74.8	72.9	179.5

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

2000 PMR REPORT # 55 **SECTION E: INSECT PESTS OF CEREAL, FORAGE CROPS, and OILSEEDS**
ICAR: 61006537

CROP: Beans (*Phaseolus vulgaris* L.), Variety SW3308
PEST: Bean leaf beetle , *Cerotoma trifurcata (*Förster)

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TITLE: BEAN LEAF BEETLE CONTROL WITH SEED TREATMENTS IN BEANS

MATERIALS: MAXIM XL 324FS (fludioxonil + mefenoxam, 231 + 93 g ai/L); COUNTER 15G (terbufos, 15% w/w); AGROX DL Plus (lindane + captan + diazinon, 25% + 15% + 15% w/w); ADMIRE 240 FS (imidacloprid, 240 g ai/L); FORCE 3G (tefluthrin, 3% w/w); GAUCHO 600 FS (imidacloprid 600 g ai/L); R00exp-01 600FS (600 g ai/L); CRUISER 600 FS (thiamethoxam 600 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. In-furrow granular insecticides were applied at planting using a Noble® applicator. In-furrow insecticides were applied by a single nozzle (Teejet 400 2E) mounted between the disk openers of the planter using a CO_2 plot sprayer delivering 131.5 L/ha of water. Beans were planted on May 5, 2000 in Woodstock at a seeding rate of 40 seeds per musing a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were single rows 10 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Bean leaf beetle damage was assessed on 13 June, 2000 when plants were at the first trifoliate stage. Assessment was a product of incidence (% of plants showing damage) X severity (average % leaf area damaged of those leaves showing damage). Both were estimated visually with the aid of CDA Publication 1458 (1971) assessment key 24.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: Bean leaf beetle damage was reduced significantly by CRUISER, AGROX DL Plus, and R00exp-01 seed treatments, by COUNTER applied in-furrow and by ADMIRE applied at the highest rate in-furrow.

Table 1. Assessment of bean leaf beetle damage at Woodstock, Ontario. 2000.

Treatment	Rate g ai/kg seed or g ai/100 m row	Method of Application [2]	Bean leaf beetle % Damage Index 13-6-00 1st Trifoliate
MAXIM XL (MX)	0.035 g ai/kg (0.025 g fludioxinil + 0.01 g mefenoxam)	ST	2.1 a [1]
MX + GAUCHO	0.035 g ai/kg 1.0 g ai/kg	ST	1.1 abc
MX + CRUISER	0.035 g ai/kg 0.52 g ai/kg	ST	0.4 bc
MX + AGROX DL Plus	0.035 g ai/kg 1.1 g ai/kg	ST	0.6 bc
MX + FORCE	0.035 g ai/kg 1.12 g ai/100 m row	ST IF	1.4 ab
MX + COUNTER	0.035 g ai/kg 11.25 g ai/100 m row	ST IF	0.2 c
MX + ADMIRE	0.035 g ai/kg 120 g ai/ha (0.91 g ai/100 m row)	ST IF	0.3 c
MX + ADMIRE	0.035 g ai/kg 60 g ai/ha (0.46 g ai/100 m row)	ST IF	1.1 abc
MX + ADMIRE	0.035 g ai/kg 30 g ai/ha (0.23 g ai/100 m row)	ST IF	1.0 bc
MX + R00exp-01	0.035 g ai/kg 2.04 ml ai/kg	ST	0.4 bc
LSD (P=.05)			1.1
CV			86

[1] Means followed by the same letter do not significantly differ (P= .05, LSD).

[2] ST = Seed Treatment, IF = In-Furrow.

2000 PMR REPORT # 56 **SECTION E: INSECT PESTS OF CEREAL, FORAGE CROPS, and OILSEEDS**
ICAR: 61006537

CROP: Corn (*Zea maize* L.), DKB 4442
PEST: Black Cutworm, *Agrotis ipsilon* , Hufnagel

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TITLE: CONTROL OF BLACK CUTWORM IN CORN WITH SEED TREATMENTS

MATERIALS: GAUCHO 600 FS (imidacloprid 600 g ai/L); AMBUSH 500 EC (permethrin 500 g ai/L); R00exp-01 600 FS (600 g ai/L)

METHODS: Seed was treated on 14 Aug, 2000 in 1 kg lots in individual bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag.. The seed was then mixed for 1 minute to ensure thorough seed coverage. Seed weight for DKB 4442 was 4251 seeds/kg. The crop was planted on 15 August, 2000 at Ridgetown at a seeding rate of 10 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 2 row, 2 m in length and 0.76 m apart arranged in a RCBD with 4 replications. Round galvanized metal enclosures 7.32 m X 40 cm high were installed in each plot to enclose two rows prior to the third leaf stage. The number of plants in each enclosure was thinned to 24 before infestation with black cutworm larvae at 3rd instar stage (0.75 cm average length) at a rate of 1 larva per plant on 25 August, 2000 when the corn had reached the 3 leaf stage. At dusk the larvae were placed in a hole, made with a knife cut, next to the corn plant within the enclosure. AMBUSH was applied broadcast to the plot surface prior to infestation at a rate of 300 ml/ha and pressure of 30 psi, using a 2 nozzle boom with 800 2VS tips spaced 24" apart. Straw was spread in the centre of the enclosure to provide cover. The number of individual missing/damaged/cut plants were counted and rated using the Guthrie scale (1-10), (Tseng et al, Journal of Economic Entomology, Vol. 77, no 3, June 1984) until feeding stopped.

RESULTS: Results are presented in Table 1.

CONCLUSIONS: All the seed treatments, with the exception of GAUCHO at the low rate, reduced the cutworm damage to the equivalent level as AMBUSH applied broadcast. There were fewer cut plants in most treated plots as well.

Table 1. Control of black cutworm with seed treatments at Ridgetown in 2000.

Treatment	Rate ml/kg seed	Total (# Plants Cut/plot)	# Plants Recovered 11-9-00	Final Plant Stand 11-9-00	Cutworm Damage (Guthrie 1-10) 6 leaf 8-9-00
Check		2.8 [1]	0.5	18	3.5 a
R00exp-01	7.4 ml	0.5	0.3	21	2.4 b
R00exp-01	9.2 ml	0.3	0	22	2.3 b
R00exp-01	11.06 ml	0.8	0	21	2.3 b
GAUCHO	7.4 ml	0.3	0	22	2.8 ab
GAUCHO	9.95 ml	0.3	0	23	2.6 b
AMBUSH	300 ml/ha [2]	3.5	0.5	18	2.2 b
LSD (P=0.05)		NS	NS	NS	0.8
CV		154.1	202.7	18.4	21.8

[1] Means followed by same letter do not significantly differ (P= .05, LSD).

[2] Foliar application.

2000 PMR REPORT # 57 **SECTION E: INSECT PESTS OF CEREAL, FORAGE CROPS and OILSEEDS**
ICAR: 61006537

CROP: Corn (*Zea maize* L.), cv. DKB 4442
PEST: Corn Root Worm, *Diabrotica virgifera virgifera*

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TITLE: CONTROL OF CORN ROOT WORM IN CORN WITH SEED TREATMENT

MATERIALS: GAUCHO 600 FS (imidacloprid 600 g ai/L); FORCE® 1.5 G (tefluthrin 1.5% w/w); R00exp-01 600 FS (600 g ai/L)

METHODS: Seed came pre- treated with Maxim/Apron XL (0.052 + 0.027 ml/kg seed) as a fungicide base for each treatment. Seed was then treated on 16 May, 2000 in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted to a total volume of 8.4 ml/kg using water) of the material via syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. Seed weight for DKB 4442 was 4251 seeds/kg. At one location egg inoculations were made prior to planting using a two-row cultivator modified to apply a 4 cm band of eggs, 5 cm deep and 9 cm on each side of the corn row. Eggs were suspended uniformly in a 0.15% agar solution at a concentration of 1031 eggs/ml and delivered through tubes from a holding tank at a rate of 200 ml/m by a ground driven metering pump (Demco model MP-466). Corn was planted in two-row plots with egg inoculations on 17 May, 2000 and in single row plots without inoculations on 30 May, 2000 at Ridgetown, Ontario using a two-row cone-seeder at a seeding rate of 8 seeds/m. The non-inoculated trial was planted in a location that had been continuous corn for the last 5 yr. FORCE was applied in-furrow at planting using a Noble® plot scale applicator. Plots were spaced at 0.76 m and were 8 m long in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand and plot vigor were assessed for inoculated plots on 9 June,2000 and for non-inoculated plots on 15 and 21 June, 2000 respectively. Damage assessments were recorded for inoculated plots on 26 July and for non-inoculated plots on 17 August, 2000. Four plants per plot were dug up, washed and rated for root worm damage using the Iowa 1-6 scale. The number of lodged plants in inoculated and non-inoculated plots was recorded on 8 November, 2000 and the crop was harvested on 15 November, 2000.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: In the inoculated trials, root worm control with GAUCHO was inconsistent. Control of root worm with R00exp-01 was best with the highest rate with yields and damage ratings similar to the standard FORCE 1.5 G treatments. There were no differences amongst treatments in the non-inoculated trial due to lack of natural root worm presence. None of the treatments in either trial had a significant effect on emergence or plant vigor.

Table 1. Control of western corn root worm with egg inoculations at Ridgetown in 2000.

Treatment	Rate ml/kg seed	% Emerg Inoculated 9-6-00 4-6 leaf	Plot Vigor Inoculated 1-10 9-6-00	Root Damage Iowa 1-6 26-7-00	Plants # Lodged 11-8-00	Yield Bu/acre 15-11-00
Control		67	5.3	3.9 a [2]	23.0 a	111 d
R00exp-01	7.4 ml	71	4.3	2.9 ab	4.8 b	121 bcd
R00exp-01	9.2 ml	62	2.8	2.1 bc	1.5 b	117 d
R00exp-01	11.06 ml	72	5	1.9 bc	2.0 b	130 abc
GAUCHO	7.4 ml	67	3	2.7 bc	4.5 b	132 ab
GAUCHO	9.95 ml	66	3.8	3.1 ab	7.5 b	117 cd
FORCE 1.5 G	75 g/100 m row[1]	72	4	1.7 c	2.3 b	136 a
LSD (P= .05)		NS	NS	1.1	9	12.8
CV		10.4	56.2	29.2	93.3	7

[1] applied in-furrow at planting.

[2] Means followed by same letter do not significantly differ (P=.05, LSD)

Table 2. Control of western corn root worm in natural conditions at Ridgetown, Ontario. 2000.

Treatment	Rate ml/kg seed	% Emerg Natural 15-6-00 4th leaf	% Emerg Natural 21-6-00 4-6 leaf	Plot Vigor Natural 1-10 21-6-00	Root Damage Natural Iowa 1-6 17-8-00	Plants # Lodged Natural 11-8-00	Yield Bu/acre Natural 15-11-00
Control		76	78	2.8	1.3	0	108
R00exp-01	7.4 ml	81	86	4.5	1.1	0	139
R00exp-01	9.2 ml	79	80	3.8	1.3	0	90
R00exp-01	11.06 ml	85	88	4.8	1	0	111
GAUCHO	7.4 ml	77	78	4.5	1.3	0	90
GAUCHO	9.95 ml	74	78	3.3	1.3	0	103
FORCE 1.5 G	75 g/100 m row[1]	75	77	4.5	1	0	108
LSD (P= .05)		NS	NS	NS	NS	NS	NS
CV		11.8	9.7	58.3	21.9	0	23.9

[1] applied in-furrow at planting.

2000 PMR REPORT # 58 **SECTION E: INSECT PESTS OF CEREAL, FORAGE CROPS, and OILSEEDS**
ICAR: 61006537

CROP: Corn (*Zea maize* L.), cv DeKalb 4442
PEST: European chafer, *Rhizotrogus majalis,* Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL WITH SEED TREATMENTS IN CORN

MATERIALS: MAXIM XL 324FS (fludioxonil + mefenoxam, 231 + 93 g ai/L); COUNTER 15G (terbufos, 15% w/w); AGROX DL Plus (lindane + captan + diazinon, 25% + 15% + 15% w/w); ADMIRE 240 FS (imidacloprid, 240 g ai/L); FORCE 3G (tefluthrin, 3% w/w); GAUCHO 600FS (imidacloprid, 600 g ai/L); R00exp-01 600FS (600 g ai/L); CRUISER 600 FS (thiamethoxam 600 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 minute to ensure thorough seed coverage. In furrow granular insecticides were applied using a Noble® applicator. In furrow insecticides were applied by a single nozzle Teejet 400 2E mounted between the disk openers of the planter using a CO_2 plot sprayer delivering 131.5 L/ha of water. Soybeans were planted following chemical burn down of winter wheat seedlings which were damaged by the E. chafer. The grub population at planting was approximately 3 per sq.ft. Corn was planted at 2 locations on May 4, 2000 in London and at 1 location on May 5, 2000 in Woodstock at a seeding rate of 8 seeds per meter using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were single rows 10 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Plant emergence was taken at all 3 sites on 29 May and 1 June, 2000 at the 4-5 and 5-6 leaf stage respectively. A final plant stand and vigor rating, using a scale of 1-10 (10 = most advanced plant and 1 = 10% development of the most advanced plant) were taken at all 3 sites on 22 June, 2000.

RESULTS: The results are presented in Tables 1, 2 and 3.

CONCLUSIONS: At one London location, all treatments except GAUCHO improved emergence significantly compared with untreated plots in the presence of chafers. There was no rate response with liquid ADMIRE IF at any location with the exception of vigor scores at one of the London locations. The best overall vigor was achieved with ADMIRE at the highest rate. At Woodstock, GAUCHO did improve emergence while CRUISER did not. AGROX DL Plus consistently improved emergence at both locations. All in-furrow applications of all treatments improved emergence.

Table 1. Plant emergence, vigor ratings and final stand for corn at first location in London, Ontario, 2000.

Treatment	Rate g ai/kg seed or g ai/100 m row	Method of Appli-cation[2]	% Plant Emerg 29-5-00	% Plant Emerg 1-6-00	Plot Vigor 1-10 22-6-00	Final % Plant Stand 22-6-00
MAXIM XL (MX)	0.035 g ai/kg (0.025 fludioxonil + 0.01 mefenoxam)	ST	77 bc[1]	77 bc	5.5	77
MX +GAUCHO	0.035 g ai/kg 1.0 g ai/kg	ST	73 c	72 c	4.3	74
MX +CRUISER	0.035 g ai/kg 0.52 g ai/kg	ST	87 a	88 a	4.3	86
MX +AGROX DL Plus	0.035 g ai/kg 1.1 g ai/kg	ST	81 abc	84 ab	6.8	82
MX +FORC	0.035 g ai/kg 1.12 g ai/100 m row	ST IF	86 ab	86 a	5.8	83
MX +COUNTER	0.035 g ai/kg 11.25 g ai/100 m row	ST IF	86 ab	86 a	6.5	83
MX +ADMIRE	0.035 g ai/kg 120 g ai/ha (0.91 g ai/100 m row)	ST IF	85 ab	86 a	4	84
MX +ADMIRE	0.035 g ai/kg 60 g ai/ha (0.46 g ai/100 m row)	ST IF	84 ab	87 a	6.8	84
MX +ADMIRE	0.035 g ai/kg 30 g ai/ha (0.23 g ai/100 m row)	ST IF	84 a	84 ab	4.8	82
MX +R00exp-0	0.035 g ai/kg 2.04 ml ai/kg	ST	87 a	85 a	7.3	82
LSD (P=.05)[1]			9.1	7.8	NS	NS
CV			7.6	6.5	53.1	8.2

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

[2] ST = Seed Treatment, IF = In-furrow.

Table 2. Plant emergence, vigor ratings and final stand at second location at London, Ontario, 2000.

Treatment	Rate g ai/kg seed or g ai/100 m row	Method of Appli-cation[2]	% Plant Emerg 29-5-00	% Plant Emerg 1-6-00	Plot Vigor 1-10 22-6-00	Final % Plant Stand 22-6-00
MAXIM XL (MX)	0.035 g ai/kg (0.025 fludioxonil + 0.01 mefenoxam)	ST	611	60	4.3 bc	62
MX +GAUCHO	0.035 g ai/kg 1.0 g ai/kg	ST	64	63	6.3 ab	67
MX +CRUISER	0.035 g ai/kg 0.52 g ai/kg	ST	64	64	4.0 bc	65
MX +AGROX DL Plus	0.035 g ai/kg 1.1 g ai/kg	ST	70	70	7.5 ab	72
MX +FORCE	0.035 g ai/kg 1.12 g ai/100 m row	ST IF	64	62	5.5 abc	65
MX +COUNTER	0.035 g ai/kg 11.25 g ai/100 m row	ST IF	65	65	7.0 ab	66
MX +ADMIRE	0.035 g ai/kg 120 g ai/ha (0.91 g ai/100 m row)	ST IF	68	66	2.3 c	73
MX +ADMIRE	0.035 g ai/kg 60 g ai/ha (0.46 g ai/100 m row)	ST IF	63	63	6.0 abc	71
MX +ADMIRE	0.035 g ai/kg 30 g ai/ha (0.23 g ai/100 m row)	ST IF	75	75	9.3 a	77
MX +R00exp-01	0.035 g ai/kg 2.04 ml ai/kg	ST	66	67	7.8 ab	68
LSD (P=.05)			NS	NS	3.8	NS
CV			14.1	13.5	44.1	12.8

[1] Means followed by the same letter do not significantly differ (P=.05, LSD).

[2] ST = Seed Treatment, IF = In-furrow.

Table 3. Plant emergence, vigor ratings and final stand at Woodstock, Ontario, 2000.

Treatment	Rate g ai/kg seed or g ai/100 m row	Method of Appli-cation[2]	% Plant Emerg 29-5-00	% Plant Emerg 1-6-00	Plot Vigor 1-10 22-6-00	Final % Plant Stand 22-6-00
MAXIM XL (MX)	0.035 g ai/kg (0.025 fludioxonil + 0.01 mefenoxam)	ST	57	53 c[1]	2.0 d	50 d
MX +GAUCHO	0.035 g ai/kg 1.0 g ai/kg	ST	66	69 ab	6.5 abc	69 abc
MX +CRUISER	0.035 g ai/kg 0.52 g ai/kg	ST	62	60 bc	3.8 cd	61 cd
MX +AGROX DL Plus	0.035 g ai/kg 1.1 g ai/kg	ST	65	65 ab	4.8 bcd	63 bc
MX +FORCE	0.035 g ai/kg 1.12 g ai/100 m row	ST IF	69	70 ab	5.0 a-d	66 abc
MX +COUNTER	0.035 g ai/kg 11.25 g ai/100 m row	ST IF	68	70 ab	5.8 a-d	71 abc
MX +ADMIRE	0.035 g ai/kg 120 g ai/ha (0.91 g ai/100 m row)	ST IF	68	70 ab	6.5 abc	73 ab
MX +ADMIRE	0.035 g ai/kg 60 g ai/ha (0.46 g ai/100 m row)	ST IF	72	71 ab	8.3 ab	70 abc
MX +ADMIRE	0.035 g ai/kg 30 g ai/ha (0.23 g ai/100 m row)	ST IF	74	71 ab	8.8 a	76 a
MX +R00exp-01	0.035 g ai/kg 2.04 ml ai/kg	ST	73	74 a	8.5 ab	74 ab
LSD (P=.05)			NS	10.9	3.8	11.5
CV			11.2	11.2	43.9	11.8

[1] Means followed by the same letter do not significantly differ (P= 05, LSD).

[2] ST = Seed Treatment, IF = In-furrow.

2000 PMR REPORT # 59 **SECTION E: INSECT PESTS OF CEREAL, FORAGE CROPS and OILSEEDS**
ICAR: 61006537

CROP: Corn (*Zea maize* L), cv. DKB 385B
PEST: Corn flea beetle, *Chaetocnema pulicaria,* Melsheimer

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TITLE: CONTROL OF FLEA BEETLE IN CORN WITH SEED TREATMENTS

MATERIALS: GAUCHO 600 FS (imidacloprid 600 g ai/L);R00exp-01 600 FS (600 g ai/L); CRUISER 350 FS (thiamethoxam 350 g ai/L); MAXIM/APRON XL (fludioxonil + metalaxyl-m, 231 g + 93 g ai/L)

METHODS: Seed came treated with Maxim/Apron XL (0.052 + 0.027 ml/kg seed) as a fungicide base. Seed was then treated on 30 May, 2000 in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted to a total volume of 5 ml/kg using water) of the material via syringe to each bag. The seed was then mixed for 1 minute to ensure thorough seed coverage. Seed weight for DKB 385B was 5319 seeds/kg. Corn was planted in 4 row plots on 29 May, 2000 at Ridgetown, Ontario using a two-row cone-seeder at 8 seeds/m. Rows were spaced 0.76 m apart and plots were 3 m long in a Latin Square with 12 replications. The plots were fertilized and maintained according to provincial recommendations. Emergence counts were taken on 7 and 26 June , 2000 respectively. Vigor was assessed using a scale of 1-10(10= most advanced plant and 1= 10% development of the most advanced plant) on 26 June, 2000. Plant feeding by flea beetles was assessed at the 4th leaf stage on the bottom leaves of 10 plants/plot by counting the number of feeding scars/leaf on 26 June, 2000.

RESULTS: See Table 1.

CONCLUSIONS: Flea beetle feeding was reduced by up to 60% using seed treatments. With the exception of GAUCHO at the lowest rate, there was no rate response for any of the treatments. All materials at all rates provided about the same protection. No stewart's wilt was evident in this trial.

Table 1. Seed treatments for the control of flea beetle in corn at Ridgetown, Ontario, 2000.

Treatment	Rate ml/kg seed	Plant Emergence (3 m row) 7-6-00	Plant Emergence (3 m row) 26-6-00	Plant Vigor (1-10) 26-6-00	Flea beetle Feeding scars (10 plants) 26-6-00
CHECK		24	24	5.1	0.88 a[1]
GAUCHO	2.5 ml	24	25	5.8	0.51 bc
GAUCHO	2 ml	23	25	5.9	0.49 bc
GAUCHO	1.5 ml	24	25	6.2	0.38 c
GAUCHO	0.83 ml	24	24	4.9	0.70 ab
CRUISER	5.71 ml	24	25	5.4	0.39 c
CRUISER	4.28 ml	24	24	5	0.33 c
CRUISER	2.85 ml	24	25	5.9	0.27 c
CRUISER	1.42 ml	24	24	6.3	0.36 c
R00exp-01	0.83 ml	23	25	6.1	0.41 c
R00exp-01	0.41 ml	24	25	7.7	0.30 c
R00exp-01	0.20 ml	24	25	6.6	0.48 bc
LSD (P =.05)		NS	NS	NS	0.25
CV		6.1	4.2	55.1	66.5

[1] Means followed by same letter do not significantly differ (P= .05, LSD).

2000 PRM REPORT # 60 **SECTION E: INSECT PESTS OF CEREAL, FORAGE, AND OILSEED CROPS**
ICAR : 61006537

CROP: Corn (*Zea maize* L.), hybrid DKB 4442
PEST: Wireworm, Elateridae, sp unknown

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TITLE: CONTROL OF WIREWORM IN FIELD CORN WITH SEED TREATMENTS

MATERIALS: AGROX DL Plus (lindane + captan + diazinon, 25% + 15% + 15% w/w); CM (captan + metalaxyl, 400 + 360 g ai/L); FORCE 3G (tefluthrin, 3% w/w); CRUISER 600 FS (thiamethoxam, 600 g ai/L); COUNTER 15G (terbufos, 15% w/w); MAXIM XL 324 FS (fludioxonil + methenoxam, 231 + 93 g ai/L); KERNEL GUARD SUPREME (permethrin + carboxin, 10.42% + 14.0% w/w); L1012-A1 (imidacloprid 600 g ai/L); R00exp-01 600FS (600 g ai/L)

METHODS: Seed was separated into normal and large size kernels using a #20 screen,(1000 seed weights of 195 and 257 g, respectively). Seed was treated on 8 May, 2000 in 1 kg lots in individual plastic bags by applying the treatment via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. Seed weight for DKB 4442 was 4251 seeds/kg. The crop was planted on May 8, 2000 at Rodney, Ontario using a two-row cone-seeder mounted on a John Deere Max Emerge planter at 80 seeds per plot. Plots were single rows spaced at 0.76 m and 10 m in length placed in randomized complete block design with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was determined at 2nd leaf stage on 5 June, 2000. Vigor assessment, using a scale of 1-10 (10 = most advanced plant and 1= 10 % development of the most advanced plant) , and a final plant stand were taken at 5-6 leaf stage on 14 June, 2000. Wireworms were counted on 22 June, 2000, by digging up 1 m of row in a trench 15.2 cm deep and 10.16 cm wide. The soil was sifted and wireworms were separated.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: Seed treatments had the biggest impact on emergence of normal sized seeds of the same lot. Perhaps larger sized seed had more vigour or larger seed received more active ingredient per kernel. R00exp-01 may have shown some phytotoxicity at the highest rate. None of the materials were better than AGROX DL plus, the current standard. The fungicide MAXIM XL, on its own, improved emergence equally as well as MAXIM XL plus insecticide.

Table 1. Wireworm (WW) control in field corn with seed treatments on normal seed at Rodney, Ontario, 2000.

Treatment	Rate ml or g/kg	Plot Emergence % plants 5-6-00	Plot Vigor 1-10 14-6-00	Final Stand % plants 14-6-00	# WW[2] / m row 22-6-00
Untreated		41 d[1]	1.5 c	43 e	4.5
Captan-metalaxyl (CM)	5 ml	58 bc	3.5 ab	57 d	2.3
CM + L1012-A1	5 ml + 0.83 ml	72 a	5.0 a	71 ab	2.8
CM+ L1012-A1	5 ml + 0.42 ml	73 a	4.5 ab	75 ab	2.3
CM + R00exp-01	5 ml + 0.83 ml	56 c	3.0 bc	59 cd	4.3
CM + R00exp-01	5 ml + 0.42 ml	71 a	5.0 a	76 a	5
CM+KERNEL GUARD SUPREME	5 ml + 2.4 g	66 abc	3.5 ab	72 ab	2.8
CM + AGROX DL Plus	5 ml + 2 g	72 a	4.3 ab	72 ab	3.8
MAXIM XL (MX)	0.11 ml	65 abc	3.8 ab	66 bcd	2.8
MX + AGROX DL Plus	3 ml + 2 g	67 ab	4.0 ab	72 ab	1.5
MX + CRUISER	3 ml + 50 g	69 a	4.0 ab	75 ab	2.8
MX + FORCE	3 ml + 3.75 g IF	70 a	4.0 ab	69 ab	0.8
MX + COUNTER	3 ml + 7.5 g IF	63 abc	4.5 ab	68 abc	1.3
LSD (P=.05)		9.8	1.7	9.8	NS
CV		10.6	31.1	10.2	91.3

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

[2] Wireworms.

Table 2. Wireworm (WW) control in field corn with seed treatments using large seed in Rodney, Ontario, 2000.

Treatment	Rate ml or g/kg seed	Plot Emergence % plants 5-6-00	Plant Vigour 1-10 14-6-00	Final Stand % plants 14-6-00	#WW[2] / m row 22-6-00
Captan-metalaxyl (CM)	5 ml	68 b[1]	4	75	2.5
CM + L1012-A1	5 ml + 0.83 ml	80 a	6	84	0.5
CM + L1012-A1	5 ml + 0.42 ml	84 a	5	80	1.8
CM + R00exp-01	5 ml + 0.83 ml	81 a	5.5	86	2.5
CM + R00exp-01	5 ml + 0.42 ml	83 a	6	84	5.5
CM + KERNEL SUPREME GUARD	5 ml + 2.4 g	83 a	5.3	86	2.8
CM + AGROX DL Plus	5 ml + 2.0 g	83 a	6	76	2.8
LSD (P=.05)		8.5	NS	NS	NS
CV		7.1	18.8	7.8	77.5

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

[2] Wireworm.

2000 PMR REPORT # 61 **SECTION E: INSECT PESTS OF CEREAL, FORAGE CROPS, and OILSEEDS**
ICAR: 61006537

CROP: Soybeans (*Glycine max* (L.) Merr), Variety SW3308
PEST: European chafer, *Rhizotrogus majalis,* Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL WITH SEED TREATMENTS IN SOYBEANS

MATERIALS: MAXIM XL 324FS (fludioxonil + mefenoxam, 231 + 93 g ai/L); COUNTER 15G (terbufos, 15% w/w); AGROX DL Plus (lindane + captan + diazinon, 25% + 15% + 15% w/w); ADMIRE 240 FS (imidacloprid, 240 g ai/L); FORCE 3G (tefluthrin, 3% w/w); GAUCHO 600FS (imidacloprid 600 g ai/L); R00exp-01 600FS (600 g ai/L); CRUISER 600 FS (thiamethoxam 600 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 minute to ensure thorough seed coverage. In-furrow granular insecticides were applied during planting using a Noble® applicator. In-furrow insecticides were applied by a single nozzle (Teejet 400 2E) mounted between the disk openers of the planter using a CO_2 plot sprayer delivering 131.5 L/ha of water. Beans were planted at 2 locations on 5 May, 2000 at London and Woodstock at a seeding rate of 8 seeds per m using a 2 row cone-seeder mounted on a John Deere Max Emerge planter. Plots were single rows 10 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Plant stand (total emergence of plot) and vigor ratings using a scale of 1-10 (10 = most advanced plant and 1= 10 % development of the most advanced plant) were taken on 8 June and 22 June, 2000 at Woodstock and on 22 June, 2000 at London.

RESULTS: See Tables 1and 2.

CONCLUSIONS: There were no significant differences between treatments at the Woodstock site. CRUISER, AGROX DL Plus and R00exp-01 seed treatments provided equivalent protection against European chafers. COUNTER applied in-furrow also provided equivalent protection to AGROX DL Plus. FORCE, ADMIRE and GAUCHO did not control European chafers. None of the treatments provided complete protection.

Table 1. Control of European chafer at Woodstock, Ontario, 2000.

Treatment	Rate g ai/kg seed or g ai/100 m row	Method of Application[1]	% Emerg 8-6-00	Vigor 1-10 8-6-00	Stand % plant 22-6-00	Vigor 1-10 22-6-00
MAXIM XL (MX)	0.035 g ai/kg (0.025 fludioxonil + 0.01mefenoxam)	ST	75	4.3	72	4
MX +GAUCHO	0.035 g ai/kg 1.0 g ai/kg	ST	84	6.8	66	6.5
MX +CRUISER	0.035 g ai/kg 0.2 g ai/kg	ST	86	5.3	85	5.8
MX +AGROX DL Plus	0.035 g ai/kg 1.1 g ai/kg	ST	79	6.8	77	4
MX +FORCE	0.035 g ai/kg 1.12 g ai/100 m row	ST IF	78	5.5	78	4
MX +COUNTER	0.035 g ai/kg 11.25 g ai/100 m row	ST IF	76	6.5	69	3.3
MX +ADMIRE	0.035 g ai/kg 120 g ai/ha (0.91 g ai/100 m row)	ST IF	89	5.8	77	6
MX +ADMIRE	0.035 g ai/kg 60 g ai/ha (0.46 g ai/100 m row)	ST IF	84	6.3	88	7
MX +ADMIRE	0.035 g ai/kg 30 g ai/ha (0.23 g ai/100 m row)	ST IF	85	6.5	86	6.8
MX +R00exp-01	0.035 g ai/kg 2.04 ml ai/kg	ST	88	7.5	86	8
LSD (P=.05)			NS	NS	NS	NS
CV			10.1	25.1	16.2	56.4

[1] ST=Seed Treatment, IF=In-Furrow.

Table 2. Control of European chafer at London, Ontario, 2000.

Treatment	Rate g ai/kg seed or g ai/100 m row	Method of Application[2]	Stand % plant 22-6-00	Vigor 1-10 22-6-00
MAXIM XL (MX)	0.035 g ai/kg (0.025 fludioxonil + 0.01 mefenoxam)	ST	40 c [1]	3.3 c
MX +GAUCHO	0.035 g ai/kg 1.0 g ai/kg	ST	53 b	5.0 abc
MX +CRUISER	0.035 g ai/kg 0.52 g ai/kg	ST	74 a	7.0 ab
MX +AGROX DL Plus	0.035 g ai/kg 1.1 g ai/kg	ST	71 a	7.5 a
MX +FORCE	0.035 g ai/kg 1.12 g ai/100 m row	ST IF	49 bc	3.8 bc
MX +COUNTER	0.035 g ai/kg 11.25 g ai/100 m row	ST IF	76 a	8.5 a
MX +ADMIRE	0.035 g ai/kg 120 g ai/ha (0.91 g ai/100 m row)	ST IF	52 bc	3.3 c
MX +ADMIRE	0.035 g ai/kg 60 g ai/ha (0.46 g ai/100 m row)	ST IF	45 bc	3.5 bc
MX +ADMIRE	0.035 g ai/kg 30 g ai/ha (0.23 g ai/100 m row)	ST IF	52 bc	5.5 abc
MX +R00exp-01	0.035 g ai/kg 2.04 ml ai/kg	ST	80 a	6.8 abc
LSD (P=.05)			11.9	3.7
CV			13.9	47.1

[1] Means followed by the same letter do not significantly differ (P=.05, LSD).

[2] ST=Seed Treatment, IF=In-Furrow.

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SECTION F: **ORNAMENTALS and GREENHOUSE /PLANTES ORNEMENTALES et DE SERRE**

REPORT/RAPPORT #: **62 - 63**

PAGES: **157 - 160**

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2000 PMR REPORT # 62 **SECTION F: INSECT PESTS OF ORNAMENTALS and GREENHOUSE**

CROP: Red pine (*Pinus resinosa* L.)
PEST: Pine false webworm, *Acantholyda erythrocephala* (L.)

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TITLE: EFFICACY OF CONSERVE 120 SC AGAINST THE PINE FALSE WEBWORM IN RED PINE, 2000

MATERIALS: CONSERVE 120 SC (spinosad, *Saccharopolyspora spinosa*)

METHODS: The trial was located near Orangeville, ON. Rows of red pine spaced 2.5 m apart with 1.5 m between trees within the row were used. There were 9 rows of untreated trees between each block. The four treatments were arranged in a randomized complete block design, with 15 replicates and each tree representing one plot. Previously marked pine false webworm (PFWW) egg masses were monitored every 3 days for percent egg hatch. Foliar sprays were applied on 30 May when egg hatch reached 75%. Foliar insecticides were applied to all trees of each block, using a motorized fogger backpack sprayer that delivered 100 L/ha of spray solution at 200 kPa. PFWW efficacy was determined by: percent visual control evaluation 24 days after application (evaluation timing is appropriate later due to varying stages of symptomology: tremours, paralysis and eventually death), percent visual defoliation on new and one year old growth 50 days after application (5 marked locations per tree). Measurements of frass accumulation (collected in pans beneath each tree and sieved) were also collected. Results were analyzed using Duncan's New Multiple Range Test ($p<0.05$).

RESULTS: As outlined in Table 1.

CONCLUSIONS: All CONSERVE 120 SC treatments significantly lowered frass weights and decreased defoliation to one year old foliage compared to the untreated control. Efficacy was excellent at all three rates examined. The 50 g a.i./ha rate of CONSERVE 120 SC provided the highest level of foliage protection at 93.3%. Current year foliage remained relatively unaffected by PFWW infestation, which supports the preference of PFWW to one-year-old foliage. Application at 75% egg hatch provided optimum control.

Table 1. Efficacy of CONSERVE 120 SC against pine false webworm in red pine, 2000.

Treatments	Rate of Product g a.i./ha	% Visual Control June 23	% Visual Defoliation of New Growth July 19	% Visual Defoliation of One Year Old Growth July 19	Dried Frass Weight (g) July 20
Untreated	-	00.0 b[1]	0.8 a	87.0 a	4.6 a
CONSERVE 120 SC	25	85.3 a	0.0 b	2.2 b	0.8 b
CONSERVE 120 SC	50	93.3 a	0.0 b	1.3 b	1.0 b
CONSERVE 120 SC	100	89.5 a	0.0 b	0.9 b	1.0 b

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Duncan's New MRT).

2000 PMR REPORT # 63 **SECTION F: INSECT PESTS OF ORNAMENTALS and GREENHOUSE**
STUDY DATABASE: 87000180

CROP: Poplar, *Populus x deltoides* 'Assiniboine' and 'Walker'
PEST: Cottonwood leafmining beetle, *Zeugophora scutellaris* Suffrian

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TITLE: EVALUATION OF PRODUCTS FOR CONTROL OF COTTONWOOD LEAFMINING BEETLE ON POPLAR IN SASKATCHEWAN, IN 2000

MATERIALS: ADMIRE (imidacloprid 24%), CYGON (dimethoate 48%), ORTHENE (acephate 75%)

METHODS: The cottonwood leafmining beetle has the potential to reduce the annual growth of hybrid poplar stooling beds that are used for cutting production at the Shelterbelt Centre. The trial was conducted on five-year old Assiniboine and Walker poplar stooling beds located on the PFRA Shelterbelt Centre (SE 11-18-13-W2) near Indian Head, Saskatchewan. The trial was set up on three rows of poplar stooling beds; one row of Assiniboine poplar and two rows of Walker poplar, all spaced one metre apart within the row. Treatments included imidacloprid at 0.04 kg ai/1000 L, dimethoate at 0.24 kg ai/1000 L, acephate at 0.64 kg ai/1000 L and a water applied check. The four treatments were replicated five times in a randomized complete block design. Two replications were set up on Assiniboine poplar and the other three replications were set up on Walker poplar. Treatment plots were 15 m in length, with a five metre buffer between plots.

Treatments were applied (27 July) with a hand gun attached to a high pressure sprayer at 480 kPa at a rate of 22 L of solution per 100 m^2 of plant surface area. Plants were sprayed until the foliage was wet, but not dripping. Treatments were applied to both sides of the row. A pre-spray evaluation was conducted by randomly collecting 50 infested leaves from the trial area and recording the number of larvae per leaf, the size of each larvae and the size of each mined area. The number of infested leaves randomly selected per plant ranged from no leaves to a maximum of two leaves per plant. Assessment of plant phytotoxicity and cottonwood leafmining beetle larval populations was conducted (31 July) four days after treatment. Assessment of larval populations was conducted by randomly collecting 20 infested leaves from each treatment plot and recording the same data as collected for the pre-treatment evaluation. Data was analysed using a two-way Analysis of Variance with the means separated by Duncan's Multiple Range Test.

RESULTS: No phytotoxic damage was noted on poplar plants treated with ADMIRE, CYGON or ORTHENE. The pre-spray evaluation indicated that each infested leaf had an average of 2.18 larvae, with each larva averaging 2.1 mm in length and that each larva had already mined a 49.1 mm^2 area. Four days after treatment, all three products had significantly reduced cottonwood leafmining larval populations compared to the water applied check (Table 1). Larvae recovered from the post-treatment water applied check plots measured 3.5 mm in length. The area mined by the cottonwood leafmining beetle had increased three-fold from the pre-spray evaluation to the post-spray evaluation in the water applied check.

CONCLUSIONS: ADMIRE, CYGON or ORTHENE applied as a foliar spray to hybrid poplar when damage by cottonwood leafmining beetle is first noticeable, will effectively control cottonwood leafmining beetle larvae populations.

Table 1. Evaluation of products for control of cottonwood leafmining beetle at Indian Head, Saskatchewan in 2000.

Treatment	Rate kg / 1000 L	Damaged area (mm^2)	Larvae / leaf
ADMIRE	0.173	50.4	0.010 b[1]
CYGON	0.5	47.2	0.000 b
ORTHENE	0.85	42.5	0.000 b
Water check	-	145.2	1.460 a

[1] Means in the same column followed by the same letter are not significantly different at the 5% level according to the Duncan's Multiple Range Test.

END OF SECTION F
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SECTION G: **BASIC STUDIES (ENTOMOLOGY) / ÉTUDES DE BASE (ENTOMOLOGIE)**

REPORT/RAPPORT #: **64**

PAGES: **161 - 163**

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2000 PMR REPORT # 64 **SECTION G: BASIC STUDIES - Entomology**
STUDY BASE NUMBER: 280-1252-9913

CROP: Potato
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: SUSCEPTIBILITY TO IMIDACLOPRID, THIAMETHOXAM AND OTHER INSECTICIDES OF FIELD-COLLECTED ADULT COLORADO POTATO BEETLES FROM ACROSS CANADA IN BIOASSAY, 2000

MATERIALS: Technical (>95% purity) imidacloprid, thiamethoxam, cypermethrin, azinphosmethyl, endosulfan

METHODS: In a Potter spray tower, 5 ml of technical (>95% purity) insecticide in 19:1 acetone:olive oil were sprayed directly onto two replicates of ten adult CPB collected from field populations from seven provinces. Bioassays were repeated to give 4 replicates. Four to five concentrations were selected to kill from 10 to 90% of the treated insects. Results were compared to the standard, insecticide-susceptible, lab-reared strain (Lab-S) to give the Standard Tolerance Ratio (LC_{50} subject population/LC_{50} standard Lab-S strain). The Field Tolerance Ratio (FTR) (LC_{50} subject population/LC_{50} most susceptible population) provided an index of the total variation in susceptibility to imidacloprid or thiamethoxam among all tested populations. The results were compared to the previous four years; the numbers of subject field populations tested (n) were not the same in different years nor for different compounds (Table 1).

RESULTS: In direct contact bioassays in 2000, the ratio of the LC_{50} for imidacloprid of the most tolerant strain to that of the Lab-S strain was 4.3x at 1 DAT and 6.1x at 8 DAT (Table 2). The LC_{50} of imidacloprid to the Lab-S strain was 2.2 ppm at 1 day after treatment (DAT) and increased to 5.4 ppm at 8 DAT, representing adult recovery from intoxication after exposure to the insecticide. At 8 DAT, 16 out of 39 field populations tested were slightly more tolerant to imidacloprid than the Lab-S strain. Calculation of the FTR using the most susceptible population produced maximum ratios for imidacloprid of 10.4x at 1 DAT and 18.3x at 8 DAT (Table 2 - in brackets). The FTR for thiamethoxam at 8 DAT was 4.8x; little recovery from thiamethoxam was noted. For the other insecticides tested, the laboratory CPB strain was the most susceptible. Comparisons of maximum STR's for 1997-2000 did not indicate any major change in tolerance to cypermethrin, azinphosmethyl and endosulfan for any of the surveyed CPB populations.

CONCLUSIONS: Since the first survey for imidacloprid in 1996, there has been no significant change in maximum FTR, either 1 or 8 DAT. The 2000 range in susceptibility to thiamethoxam for CPB populations was narrower than for imidacloprid. Differences in susceptibility among field populations likely reflected natural variability among populations and difference in ages of collected adults. In the limited 2000 survey, observed resistance ratios for cypermethrin, azinphosmethyl and endosulfan had not changed significantly from 1999.

Table 1. Number of field populations of adults tested in direct contact bioassays for each insecticide in each year.

Insecticide	Number of field populations tested				
	1996	1997	1998	1999	2000
imidacloprid	14	14	28	28	39
thiamethoxam	-	-	-	-	40
cypermethrin	9	8	8	8	13
azinphosmethyl	6	8	9	4	5
endosulfan	7	7	8	4	3

Table 2. Dose response of populations of CPB to selected insecticides applied by direct contact in bioassay, 2000.

Insecticide	DAT	Range[1] LC_{50} (ppm)	Maximum Standard Tolerance Ratio[2]				
			1996	1997	1998	1999	2000
imidacloprid	1	0.9-9.4	4.4 (14.0)[3]	4.5 (10.0)	1.6 (4.0)	2.7 (6.0)	4.3 (10.4)
	8	1.8-33.0	-	6.0 (23.1)	2.2 (10.7)	4.6 (13.0)	6.1 (18.3)
thiamethoxam	1	1.2-<10.0	-	-	-	-	<2.5 (<8.3)
	8	4.2-20.0	-	-	-	-	3.3 (4.8)
cypermethrin	2	12.0 - 900	64	28	34.2	>45.0	75
azinphosmethyl	1	250 - 2300	30	12	4.6	10.9	9.2
endosulfan	1	65.0 - 3330	166	111.1	>100.0	>100.0	51

[1] Observed range in LC_{50} (ppm) in 2000.

[2] Ratio of LC_{50} of subject CPB population/LC_{50} of the standard susceptible Lab-S strain; for conventional insecticides, this represents the resistance ratio.

[3] Field Tolerance Ratio (FTR) (in brackets) = LC_{50} of subject CPB population/LC_{50} of most susceptible CPB population.

END OF SECTION G
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SECTION H (a-c): PEST MANAGEMENT METHODS /Méthodes de lutte dirigée

Ha BIOLOGICAL CONTROL OF WEEDS /Lutte biologiques - mauvaises herbes

REPORT/RAPPORT #: **No reports**

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Hb BIOLOGICAL CONTROL of Insects, Mites, Nematodes /Lutte biologiques - insectes, acariens, nématodes

REPORT/RAPPORT #: **65**

PAGES: **164 - 166**

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Hc SEMIOCHEMICALS - Insect Pheromones and Natural Products / Sémiochimiques - Phéromones des insectes et prodruits naturelles

REPORT/RAPPORT #: **No reports**

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2000 RAPPORT RDL # 65 **SECTION Hb: LA LUTTE BIOLOGIQUE -insectes acariens, nématodes**
ICAR: 94000464

CULTURE: Pommes
RAVAGEUR: Tétranyque rouge, *Panonychus ulmi* (Koch)

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TITRE: LÂCHERS DE LA PUNAISE TRANSLUCIDE DANS LES VERGERS DE POMMIERS

PRODUITS: Punaise translucide, glassy-winged mirid bug, *Hyaliodes vitripennis* (Say) (Heteroptera: Miridae)

MÉTHODES: Un lâcher de larves principalement de stades II et III de punaises translucides *Hyaliodes vitripennis* (Say) (Heteroptera: Miridae) a été effectué le 20 juillet dans un verger commercial de Rougemont, Québec, dans la perspective d'un établissement permanent du prédateur indigène dans cette zone et du contrôle biologique des populations de tétranyques rouges. Les larves ont été récoltées dans les pommiers standards d'un verger commercial de la même région pomicole quelques heures précédant leur introduction dans le verger expérimental. Les larves ont été placées individuellement dans des godets de 5ml contenant une feuille de pommier. Huit pommiers ont été sélectionnés aléatoirement dans la partie centrale du verger récepteur, dans lesquels la densité de population de tétranyques rouges a été évaluée préalablement. Les pommiers ont été appariés selon la densité de tétranyques rouges et les deux traitements ont été distribués aléatoirement selon les paires de pommiers. L'un des traitements consistait à relâcher 200 larves de punaise translucide dans chacun des quatre pommiers alors que pour le second traitement aucun lâcher n'était réalisé dans les quatre pommiers considérés comme témoins. Le lâcher a été accompli en brochant individuellement les feuilles de pommiers portant la larve sur une feuille de pommier choisie aléatoirement dans les arbres récepteurs. Afin de déterminer l'impact de la prédation de la punaise translucide sur le taux d'accroissement des populations de tétranyques rouges, le nombre de punaises translucides et la présence de formes mobiles et d'œufs de tétranyques rouges ont été notés sur les feuilles de 20 pousses végétatives et de 20 bouquets floraux choisis aléatoirement dans chacun des pommiers, 4 heures avant le traitement, 24 heures après le traitement, ainsi que 6, 13, 21, et 28 jours après le traitement. À chaque date d'échantillonnage, le nombre de punaises translucides et de feuilles infestées par les tétranyques rouges pour chacun des traitements ont été comparés à l'aide d'un test de *t* apparié. La densité de population de tétranyques rouges a été pondérée en fonction de la population initiale observée dans chacun des arbres.

RÉSULTATS: Voir le tableau 1 ci-dessous.

CONCLUSIONS: La présence du prédateur a été notée dans les pommiers traités durant la période complète d'échantillonnage avec une densité de population significativement plus élevée durant les journées suivant le lâcher. La faible proportion de prédateurs observés comparativement à la quantité relâchée est principalement attribuable à la méthode d'échantillonnage quoiqu'il n'est pas exclu que des facteurs de mortalité soient aussi en cause. Néanmoins, la présence du prédateur dans le verger quatre semaines après son introduction suggère que la méthode d'introduction et le nouvel environnement du prédateur n'ont pas décimés complètement la population introduite et que l'établissement permanent du prédateur semble réalisable. La diminution temporelle de la densité de la population de prédateurs dans les arbres traités suggère une dispersion verticale intra-pommiers des larves pendant les jours suivant le lâcher et une dispersion inter-pommiers après l'atteinte du stade adulte que nous avons observée 13 jours après le lâcher. C'est d'ailleurs à partir de ce moment que la présence de quelques prédateurs a été notée dans des pommiers situés à plus de 45 m d'un site (pommier) d'introduction. L'importance du taux d'infestation par les tétranyques rouges observé dans les pommiers témoins par rapport aux pommiers traités suggère que le prédateur a consommé des tétranyques rouges suite à son introduction dans le verger et qu'une période d'environ six jours a été nécessaire pour que la prédation aie un impact significatif sur la densité de population de tétranyques rouges. Il semblerait que le taux de prédation exercé par les punaises translucides introduites peut mener à un contrôle biologique des tétranyques rouges.

Tableau 1. Nombre moyen de punaises translucides et de feuilles infestées par les tétranyques rouges par arbre.

Temps[1]	punaises translucides			tétranyques rouges		
	Témoins	Traités	p	Témoins	Traités	p
T0	0 ± 0	0,8 ± 1,0	108	101 ± 53	104 ± 105	533
T1	0 ± 0	14,8 ± 5,0	5	107 ± 49	87 ± 97	106
T2	0 ± 0	2,5 ± 1,0	8	121 ± 59	82 ± 79	37
T3	0 ± 0	4 ± 2,6	27	150 ± 87	95 ± 115	302
T4	0,3 ± 0,5	1,3 ± 1,9	211	213 ± 67	118 ± 83	7
T5	0 ± 0	1,3 ± 1,0	40	237 ± 74	138 ± 80	9

[1] TO: 4 heures avant le traitement; T1: 24 heures après le traitement; T2: 6 jours après le traitement; T3: 13 jours après le traitement; T4: 21 jours après le traitement; T5: 28 jours après le traitement.

END OF SECTION H
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SECTION I: **INSECT AND MITE PEST SURVEYS AND OUTBREAKS**
/Enquêtes phytosanitires et infestations

REPORT/RAPPORT #: **66-70**

PAGES: **167 - 177**

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2000 PMR REPORT # 66 **SECTION I:** **INSECT AND MITE SURVEYS AND OUTBREAKS**
STUDY DATA BASE: 375 - 1122 - 9614

CROP: Alfalfa (*Medicago officianalis* L.)
PEST: Alfalfa blotch leafminer (*Agromyza frontinella* (Rondani))

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TITLE: SURVEY FOR THE OCCURRENCE OF ALFALFA BLOTCH LEAFMINER IN EASTERN SASKATCHEWAN

METHODS: On September 16-18, 2000, a survey of alfalfa fields was conducted by JJS in three transects, southeast, east, and northeast of Saskatoon to the Manitoba border. The method of field selection was to choose a field composed of a substantial amount of alfalfa that was at least 50 km from the last sampling location. In the field, 30 stems of alfalfa were collected by randomly severing a stem at soil level every 3 to 5 walking steps in a transect at 30 stops across the field. The samples were inspected for alfalfa blotch leafminer damage and placed in a paper bag that was labeled with the global positioning system location, field type and size. Samples were then shipped via air express to RCV for closer examination.

RESULTS: Thirty sites of alfalfa under various management practices were inspected in the survey. No damage that could be attributed to alfalfa blotch leafminer was seen in the field (JJS) or in the laboratory (RCV). Field locations and types are listed in Table 1. Of note was the absence of alfalfa crops for dehydration, caused by the closure of three dehydration plants in the northeast in the spring of 2000. Fields that had been in dehy production in 1999 were left for hay or even seed production.

CONCLUSIONS: Despite its presence in Manitoba, the results of this survey indicate that alfalfa blotch leaf miner is not yet present in alfalfa in eastern Saskatchewan. However, levels of leafminer damage were reported to be low in Manitoba in 2000, and the possibility exists that alfalfa blotch leafminer is present in Saskatchewan but in frequencies below the level of detection of this survey.

Table 1. Location of alfalfa fields sampled for the presence of alfalfa blotch leaf miner in eastern Saskatchewan in September 2000.

Nearest Centre	Global Positioning System Location	Field Type	Field Size (ha)	Comments
Allan	51-59-12.0 N 106-01-41.5 W	Hay[1]	50	-
Guernsey	51-53-47.2 N 105-17-11.3 W	Hay	100	-
Dafoe	51-53-47.1 N 105-17-11.4 W	Seed[2]	160	high yield
Quinton	51-23-14.7 N 104-24-47.4 W	Hay	80	-
Leross	51-16-11.9 N 103-48-44.0 W	Hay	200	grass/alfalfa
Goodeve	51-04-03.9 N 103-12-23.9 W	Hay	140	foliar pathogens
Melville	50-54-50.0 N 102-40-47.6 W	Hay	200	pure alfalfa
Atwater H	50-45-01.3 N 102-14-17.9W	Seed	180	-
Atwater P	50-45-35.9 N 102-14-17.0W	Seed	160	-
Churchbridge	51-05-46.8 N 101-53-25.5 W	Ditch sample	500 m	grass/alfalfa
Kamsack	51-23-33.0 N 101-52-40.9 W	Hay	60	alfalfa/grass/clover
Mikado	51-37-21.4 N 102-22-07.1 W	Hay	70	grass/alfalfa
Rama	51-45-34.2 N 102-59-24.7 W	Hay	50	alfalfa/grass
Wadena	51-56-23.6 N 103-47-13.1 W	Hay	30	grass/alfalfa
Smuts	52-27-46.1 N 106-04-34.3 W	Hay	80	grass/alfalfa
Tway	52-38-17.1 N 105-31-50.5 W	Hay	20	alfalfa/grass
44 Trail	52-47-00.9 N 104-57-17.9 W	Hay	15	alfalfa/grass
Melfort Res. Farm	52-49-35.5 N 104-35-40.4 W	Seed	2	research plots
Star City	52-50-13.8 N 104-20-59.3 W	Hay	160	pure alfalfa
Peesane	52-52-14.6 W 103-39-25.4 W	Hay	160	pure stand
Erwood	52-51-13.3 N 102-10-55.5 W	Seed	40	thistles
Somme Jnct	52-50-31.7 N 102-57-58.9 W	Hay	160	grass/alfalfa
Hwy 23	52-54-47.6 N 103-43-17.2 W	Seed	160	old/new growth
Zenon Park	53-06-14.3 N 103-53-44.1 W	Seed	80	stand very short
Hwy 6	52-56-41.8 N 104-36-54.0 W	Hay	15	alfalfa/grass
St. Denis	52-09 N 106-07 W	Hay	150	pure alfalfa
Carmel	52-14 N 105-21 W	Hay	20	grass/alfalfa
St. Gregor	52-11 N 104-50 W	Hay	40	grass/alfalfa
Quill Lake	51-56 N 104-13 W	Hay	30	grass/alfalfa
Saskatoon	52-04-15.2 N 106-34-34.3 W	Seed	2	research plot

[1] Hay - all samples single cut except sample from 44 Trail, which hadn't been cut at all.

[2] Seed samples - only stems with leaves collected.

2000 RAPPORT RDL # 67 SECTION I: ENQUÊTES PHYTOSANITAIRES ET INFESTATIONS

CULTURE: Pommes
RAVAGEURS: Charançon de la prune, *Conotrachelus nenuphar* (Herbst)
Mouche de la pomme, *Rhagoletis pomonella* (Walsh)
Carpocapse de la pomme, *Cydia pomonella* (L.)
Tordeuse à bandes obliques, *Choristoneura rosaceana* (Harris)
Tétranyque à deux points *Tetranychus urticae* Koch
Tétranyque rouge, *Panonychus ulmi* (Koch).

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TITRE: LES RAVAGEURS DES VERGERS DE POMMIERS DU QUÉBEC EN 2000

MÉTHODES: Dans un verger expérimental et dix vergers de pommiers commerciaux, dont un à régie biologique, une parcelle de 1-2 ha a été mise à la disposition du réseau d'avertissements phytosanitaires du pommier pour dépister les insectes et acariens nuisibles aux pommiers et évaluer leur importance au niveau de la province. Dans chacun de ces vergers-pilotes, le dépistage des lépidoptères a été réalisé à l'aide de deux pièges Phérocon et Multi-pher munis d'un diffuseur à phéromone sexuelle et disposés de part et d'autres du centre de la parcelle. Pour dépister la punaise terne et l'hoplocampe des pommes, des cartons blancs englués (15 x 20 cm) ont été placés dans les pommiers, respectivement à 70 et 150 cm au-dessus du sol à raison de deux pièges à chacun des coins de la parcelle. La mouche de la pomme a été dépistée à l'aide de sphères rouges engluées placées dans un pommier à chacun des coins de la parcelle. Les pièges ont été installés avant le début de la période d'activité des insectes concernés soit entre le 3 avril et le 12 juin 2000. La présence et le nombre d'insectes capturés ont été relevés à toutes les semaines jusqu'à la fin de la période d'activités des insectes, le dernier relevé ayant été effectué le 25 septembre 2000. Au besoin, les pièges collants ont été nettoyés ou remplacés et les diffuseurs à phéromone ont été remplacés à toutes les 4 ou 5 semaines. Les dommages à la récolte ont été évalués dans chacune des parcelles au début de septembre en échantillonnant 500 pommes récoltées aléatoirement dans 50 à 100 arbres. Ce bilan des insectes et acariens reflète la situation générale observée dans l'ensemble des régions pomicoles.

RÉSULTATS: Voir les tableaux ci-dessous.

CONCLUSIONS: Les dommages occasionnés par les insectes durant la saison 2000 et évalués à la récolte sont légèrement supérieurs à la moyenne enregistrée au cours des 10 dernières années. Les températures fraîches rencontrées durant la saison de croissance ont affecté le niveau d'activité de la majorité des insectes et ont euune incidence sur leurs contrôle. Habituellement contrôlé à l'aide d'une application à la période du calice, le charançon de la prune, *Conotrachelus nenuphar* (Herbst) a causé le plus haut pourcentage de dommage enregistré au cours des dix dernières années, principalement en raison des températures froides du printemps qui ont retardée sa période de migration et étalé sa période de ponte. Les captures et les dommages de la mouche de la pomme, *Rhagoletis pomonella* (Walsh) ont été plus élevés que la moyenne enregistrée au cours des dix dernières années. Le nombre d'adultes de carpocapse de la pomme, *Cydia pomonella* (L.), capturé dans les pièges a été plus élevé que l'année précédente et continue d'augmenter d'année en année quoique un bon niveau de contrôle a été enregistré dans la majorité des vergers-pilotes commerciaux. L'importance des dommages et des captures de la tordeuse à bandes obliques, *Choristoneura rosaceana* (Harris) démontre la progression du statut de ce ravageur particulièrement dans les régions où cet insecte posait auparavant peu de problèmes. Les densités de populations du tétranyque à deux points *Tetranychus urticae* Koch sont demeurées basses au cours de la saison alors que celles du tétranyque rouge, *Panonychus ulmi* (Koch), étaient élevées dès le début du mois d'août.

Tableau 1. Nombre total de captures par piège dans les vergers-pilotes durant la saison 2000.

	Ravageurs[1]								
	CARPO	HOP	MIN	MOU	NFV	PUN	SEC	TBO	TBR
Compton	58	26.8	3017	20.0	21	4.0	11	95	446
Dunham	82	5.0	24026	32.3	43	3.3	11	108	633
Ste-Famille (I.O.)	21	14.0	7733	1.3	2	1.8	5	52	5
Franklin	64	6.0	18987	21.3	94	0.3	76	262	376
Frelighsburg[2]	272	71.3	18965	165.5	49	7.0	33	105	393
Hemmingford	47	30.0	15033	59.0	31	4.3	52	228	661
Henryville[3]	158	65.5	5759	33.8	74	1.3	8	137	547
Oka	7	0.0	20878	5.0	59	7.5	22	94	196
Rougemont	273	3.0	68310	1.5	66	1.5	17	259	136
Saint-Joseph-du-lac	2	0.5	21652	1.5	126	3.3	26	115	45
Saint-Paul d'Abbotsford	6	0.5	22148	5.3	100	3.8	36	253	324
Période de dépistage	1 Mai - 25 Sep	25 Avril- 26 Juin	10 Avril- 25 Sep	12 Juin- 25 Sep	3 Avril- 12 Juin	3 Avril- 19 Juin	15 Mai- 25 Sep	15 Mai- 25 Sep	3 Avril- 25 Sep
Type de piège[4]	PH-1C	C B E	MP-2	S R E	MP-1	C B E	MP-3	PH-1C	PH-1C
Phéromone	Trécé		Trécé		Scentry		Scentry	Trécé	Trécé

[1] CARPO: Carpocapse de la pomme; HOP: Hoplocampe des pommes; MIN: Mineuse marbrée; MOU: Mouche de la pomme: NFV: Noctuelle du fruit vert; PUN: Punaise terne; SEC: Sésie du cornouiller; TBO: Tordeuse à bandes obliques; TBR: Tordeuse à bandes rouges; CHE: Chenilles; CHA: Charancon de la prune; APP: autres punaises phytophages.

[2] Verger non traité aux insecticides.

[3] Verger à régie biologique.

[4] PH-1C= Phérocon 1C; C B E= Carton blanc englué; MP= Multi-pher (1, 2 ou 3); S R E= sphère rouge engluée.

Tableau 2. Dommages à la récolte (%) dans les vergers-pilotes du Québec durant la saison 2000.

Année	Ravageurs[1]								
	CARPO	HOP	MOU	CHE	TBO 2e gen.	CHA	PUN	APP	PRESSION TOTALE
VERGERS COMMERCIAUX (9 sites)									
1991	0.00	0.20	0.00	0.80	0.10	0.20	1.90	0.90	4.70
1992	0.04	0.11	0.13	1.11	0.07	0.93	4.22	0.24	7.31
1993	0.00	0.04	0.07	1.18	0.00	0.07	1.64	0.27	3.38
1994	0.02	0.00	0.00	0.67	0.07	0.19	1.22	0.52	2.87
1995	0.00	0.60	0.04	1.14	0.04	0.33	2.04	0.60	4.98
1996	0.00	0.16	0.04	0.94	0.12	0.27	0.86	0.35	2.80
1997	0.00	0.18	0.00	1.22	0.13	0.04	0.77	0.11	2.67
1998	0.00	1.98	0.00	0.16	0.84	0.00	2.22	0.22	6.07
1999	0.04	1.51	0.00	1.00	0.53	0.18	0.93	0.27	4.62
2000	0.00	0.76	0.24	0.76	0.71	0.40	1.51	0.29	4.77
1991-1999	*0.01*	*0.53*	*0.03*	*0.91*	*0.21*	*0.25*	*1.76*	*0.39*	*4.38*
VERGER BIOLOGIQUE (1 site)									
2000	11.4	1.8	1.8	7.2	0.2	66.8	5.4	3.4	99.2
VERGER NON TRAITÉÉ AUX INSECTICIDES (collaboration: B.Rancourt. AAFC. Saint-Jean-sur-Richelieu)									
1991	23.0	1.4	46.0	51.2	3.2	21.6	5.2	11.8	164.0
1992	16.6	1.0	28.2	32.6	5.6	36.2	12.6	61.8	195.0
1993	58.4	2.6	49.0	15.6	20.4	80.8	4.6	19.6	251.0
1994	43.2	1.2	55.8	23.4	4.4	86.0	3.4	20.0	237.0
1995	38.0	1.0	98.4	50.6	4.8	88.2	3.2	42.0	326.0
1996	10.2	1.4	90.0	46.8	0.6	39.4	3.6	21.8	214.0
1997	15.2	1.8	96.8	63.6	1.0	86.2	3.0	14.6	282.0
1998	16.8	7.2	94.6	30.4	1.0	48.0	6.2	5.8	210.0
1999	NA	NA	NA	NA	NA	NA	NA	NA	NA
2000	27.2	7.8	86.8	57.2	4.8	88.8	11.2	19.2	303.0
1991-1999	*27.7*	*2.2*	*69.9*	*39.3*	*5.1*	*60.8*	*5.2*	*24.7*	*234.9*

[1] CARPO: Carpocapse de la pomme; HOP: Hoplocampe des pommes; MIN: Mineuse marbrée; MOU: Mouche de la pomme: NFV: Noctuelle du fruit vert; PUN: Punaise terne; SEC: Sésie du cornouiller; TBO: Tordeuse à bandes obliques; TBR: Tordeuse à bandes rouges; CHE: Chenilles; CHA: Charancon de la prune; APP: autres punaises phytophages.

2000 PMR REPORT # 68 **SECTION I: INSECT AND MITE PEST SURVEYS AND OUTBREAKS**

CROP: Roadside vegetation
PEST: Dusky click beetle, *Agriotes obscurus* (L.)
Lined click beetle, *Agriotes lineatus* (L.)

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TITLE: SURVEY FOR PRESENCE OF DUSKY AND LINED CLICK BEETLES IN SOUTH CENTRAL BRITISH COLUMBIA

MATERIALS: Pheromone-baited traps (Phero Tech Inc., Delta, BC) designed for placement on the soil surface with a ramp at each open end to allow entry of beetles into the trap chamber containing the species-specific pheromone lure.

METHODS: This survey was conducted between May 19 and June 30, 2000 beginning near Keremeos, south to Osoyoos, north to Salmon Arm, west to Kamloops and south to Merritt. Four pairs of pheromone-baited traps (pair = one of each beetle species) were placed on the ground among roadside vegetation at a frequency of one pair on average every 10 km. After one week, the four pairs of traps were emptied and relocated along the next 30- to 50-km stretch of highway. Any captured click beetles were sent to Dr. Bob Vernon (Pacific Agri-Food Research Centre, Agassiz, BC) for positive identification.

RESULTS: The pheromone-baited traps failed to capture any dusky or lined click beetles. These traps have proven very successful in detecting their presence in the Fraser Valley opf BC and in Washington.

CONCLUSIONS: *A. lineatus* and *A. obscurus* were not found along highway right-of-ways in south central BC indicating their range has likely not extended eastward beyond the Fraser Valley in BC.

2000 PMR REPORT # 69 **SECTION I: INSECT AND MITE PEST SURVEYS AND OUTBREAKS**

CROP: Tall Red Fescue, *Festuca arundinacea*
Creeping Red Fescue, *Festuca ruba ruba*
Timothy, *Phleum pratense*
Meadow Brome, *Bromus biebersteinii*

PEST: Glassy Cutworm, *Apamea devastator*

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TITLE: THE OUTBREAK OF GLASSY CUTWORM (*Apamea devastator*) (LEPIDOPTERA: NOCTUIDAE) IN ALBERTA, 2000

MATERIALS: The extent of the outbreak was assessed by observations of plant damage in seed fields and pastures. Killed or dying plants were uprooted to establish that cutworm larvae were the causal agents. Samples of larvae from the outbreak region were returned to the laboratory and reared to adults to determine species.

METHODS: Once the total area infested by glassy cutworm was estimated, the economic impact of the outbreak was estimated by assuming that 50% of the area affected was pasture and 50% was cropland. Although pasture was more severely affected than cropland in some areas, or vice versa, our 50:50 assumption encompassed the entire outbreak region. Economic losses to pasture were estimated at $36.03 per ha, a value determined by Alberta Agriculture, Food and Rural Development for insurance purposes. Determination of economic loss to cropland assumed that: 1) average crop loss was 35%, 2) the average potential seed yield was 560 kg per ha, and 3) seed value was $1.65 per kg.

To assess the likelihood of significant glassy cutworm infestations occurring again in 2001, several fields were sampled in October 2000. Plant tufts were uprooted and the crown and root zones were examined for insect larvae. Lepidopterous larvae found were reared on artificial diet until emergence of parasitoids or adult moths.

RESULTS: The crops most severely affected were tall red fescue, creeping red fescue, timothy, and meadow brome. Damage was first observed in May 2000, and was initially attributed to winter-kill. However, many fescue tufts were found to contain cutworm larvae (as many as 20 to 50 larvae per 50-cm-diameter tuft), in the crown and root zones of plants. Larvae were in various stages of development ranging from early (body length = ca. 1 cm) to final instars (body length = 3-4 cm). Crop damage ranged from some killed plant tillers within tufts to entire fields completely destroyed. Damage tended to be greatest in chaff rows, the regions within fields where plant material had been piled during the preceding year in the swathing process. Damage was also greater to crops seeded 2 to 4 years prior to the outbreak than to 1-year-old crops.
Specimens reared to adults in the laboratory were primarily glassy cutworm, *Apamea devastator* (71%), with the remainder being *Apamea indela* (17%), *Apamea cogitata* (6%), and yellow-headed cutworm, *Apamea amputatrix* (6%).

The region of northern Alberta and British Columbia infested with glassy cutworm closely corresponded to the zone of severe drought that occurred during 1998 and 1999. The infested region comprised an area of approximately 35,000 ha extending from Beaverlodge and Grande Prairie westward to northeastern British Columbia, eastward to Valleyview and High Prairie, and north to Manning. The most severe damage to seed crops and pasture occurred near Fairview, Debolt, and Bonanza in northern Alberta.

Field observations indicated that a small percentage of the larval population emerged above-ground to feed late in the day (ca. 2300 h), prompting insecticide applications, primarily with chlorpyrifos (Lorsban 4E) at a rate of 1.2 L per ha in 225 L of water. Reductions in larval populations following treatment were approximately 30%, but 90 to 95% reductions were achieved when applications were made before or during rainfall. Estimated crop losses were $495,700 to pasture and $4,462,500 to seed crops.

At least eight species of hymenopteran and two dipteran parasitoids were reared from glassy cutworm larvae. In addition, several pupal parasitoids were found.

CONCLUSIONS: A severe outbreak of glassy cutworm occurred in 2000 in fescue seed fields and pastures in the Peace River region of northwestern Alberta and northeastern British Columbia. Approximately 35,000 ha of pasture and cropland were infested, causing economic losses of approximately 5 million dollars. In October 2000, larvae were relatively abundant in fescue and timothy, but many specimens were parasitized. Populations will be monitored closely during 2001.

Acknowlegements: We are very grateful for assistance received from H. Philip and K. Clark of the B.C. Ministry of Agriculture, Food and Fisheries.

2000 PMR REPORT # 70 **SECTION I: INSECT AND MITE PEST SURVEYS AND OUTBREAKS**

CROPS: Miscellaneous

PESTS: Armyworm, *Pseudaletia unipuncta* (Haworth) in forages, spring grain crops
Black vine weevil, *Otiorhynchus sulcatus (Fabricius)* in strawberry
Potato stem borer, *Hydraecia micacea* (Esper) in potato
Philopedon plagiatum (Schaller) in snap beans
Cutworm in field corn
Small leaf chafer, *Serica tristis* (LeConte) on ornamentals
Alder flea beetle, *Altica ambiens alni* Harrison on alders
Root weevils, *Otiorhynchus* spp.
Large flour beetle, *Tribolium destructor* Uyttenboogaart in stored products
Hairy chinch bug, *Blissus leucopterus hirtus* Montandon in turf
Chainspotted geometer, *Cingilia catenaria* (Drury)

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TITLE: PROVINCIAL REPORT ON OUTBREAKS AND INFESTATIONS IN NB

RESULTS: The armyworm, *Pseudaletia unipuncta* (Haworth), infested approximately 5800 to 7000 acres of pasture, mainly in southern NB during mid- to late- July. Most infestations occurred in pastures where caterpillars had completely destroyed acres of grasses by the time the first few infestations were reported on 18 July. The caterpillars had been feeding for a few weeks and had done 80-90% of their damage. One field of forage corn had also been completely destroyed. Feeding damage was almost over by 31 July. Approximately 400-500 acres had been treated to control crop damage and 40 acres of forage and corn crops were plowed down. Damage resulted in a loss of a second cut to forage crops in numerous fields. Producers noted that an armyworm outbreak had not been seen for approximately thirty years.

The armyworm, *Pseudaletia unipuncta* (Haworth), infested approximately one thousand acres of spring grain crops (wheat, oats, barley) in the southern and southeastern part of the province. Infestations were reported from mid- to late- July. In most cases, a control measure was applied very late, when most of the damage had already occurred. Producers noted that an armyworm outbreak had not been seen for approximately thirty years.

A three-hectare strawberry field in southeastern NB was heavily infested with black vine weevil larvae, *Otiorhynchus sulcatus (Fabricius)*. Large areas had almost 100% damage, indicating that the infestation had likely been occurring for a few years. Malathion was applied but was ineffective. Later, Furadan was applied in August and was effective.

A few cases of limited damage by the potato stem borer, *Hydraecia micacea* (Esper), (Noctuidae) infesting potato plants were reported around the Grand falls area.

Adult weevils were received that had been reported to be feeding on snap bean plants in late June. The weevils were tentatively identified as *Philopedon plagiatum* (Schaller).

Ten acres of field corn was almost completely destroyed by cutworms by the time the plants were five to ten centimetres high.

A large population of small leaf chafer beetles, *Serica tristis* (LeConte), was reported to have been causing extensive defoliation on apple, lilac, cherry trees and rose bushes at a site in northern NB.

High populations of alder flea beetle larvae, *Altica ambiens alni* Harrison, were reported on alders throughout large areas of the southern part of the province. Larval feeding activity caused leaves to have a scorched appearance.

A few reports were received from the general public concerning large populations of root weevils, *Otiorhynchus* spp., dispersing. Samples consisted of *Otiorhynchus ovatus* (Linnaeus) and *Otiorhynchus ligneus* (Olivier). The large flour beetle, *Tribolium destructor* Uyttenboogaart, was received from a grocery store in Halifax. Hairy chinch bugs, *Blissus leucopterus hirtus* Montandon, were a problem in lawns. A high population (apparently hundreds) of the chainspotted geometer moth, *Cingilia catenaria* (Drury), was reported from York county.

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2000 PMR REPORT # 71

SECTION J: FRUIT - Diseases
STUDY DATA BASE#: 402-1531-8605

CROP: Apples cv. Jonagold
PEST: Grey mold, *Botrytis cinerea* Pers., Blue mold, *Penicillium expansum* Link

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TITLE: EVALUATION OF PREHARVEST AND POSTHARVEST FUNGICIDE TREATMENTS FOR CONTROL OF POSTHARVEST DECAY OF JONAGOLD APPLES, 1999

MATERIALS: VANGARD 75 WG (cyprodinil), SCALA (pyrimethanil 400g/L), SOVRAN (kresoxim-methyl 50%), BENLATE (benomyl 50%), MAESTRO (captan 75%), MERTECT (thiabendazole 45%), ELEVATE (fenhexamid 50%), *Pseudomonas syringae* strain 1100-6

METHODS: Fungicide treatments at bloom, two weeks preharvest, or bloom and two weeks preharvest were applied to four single tree replicates of Jonagold apple trees arranged in a randomized complete block design. Treatments were an unsprayed check, SOVRAN at 300 g/ha at bloom, SOVRAN at 300 g/ha at bloom and preharvest, VANGARD at 370 g/ha at bloom, VANGARD at 370 g/ha at bloom and BENLATE at 1.1 kg/ha preharvest, BENLATE at 1.1 kg/ha and MAESTRO at 3.25 kg/ha at bloom, BENLATE at 1.1 kg/ha and MAESTRO at 3.25 kg/ha at bloom and VANGARD 370 g/ha preharvest, BENLATE at 1.1 kg/ha and MAESTRO at 3.25 kg/ha at bloom and SCALA at 2L/ha preharvest, and SCALA at 2L/ha preharvest. Spray applications were made with a hand operated gun sprayer (345 KPa) to run off.. Bloom treatments were applied twice, at pink, April 30, 1999 and at full bloom, May 13, 1999. Preharvest treatments were applied September 9, 1999. Fruit harvest was October 1, 1999. At harvest, replicate subsamples of apples were selected for postharvest treatments applied October 8, 1999. Post harvest treatments applied as a three minute dip were an untreated check, MERTECT at 0.5 L/1000 L, ELEVATE at 1.8 kg/1000L, and *Pseudomonas syringae* strain 1100-6 at 10^7 colony forming units (CFU)/ml. Treated fruit were stored for four or six months in air storage at 1 ± 0.2 C. Upon removal from storage, four replicates of five fruit were wounded in triplicate, inoculated with 20 l of a *Botrytis* or *Penicillium* spore suspension (10^5 conidia/ml), and incubated at 20 C for five to seven days. Two diameters of developing rot lesions were measured and wound decay data was analyzed using the General Linear Model of SAS. Means were separated using the LSD comparative test.

RESULTS: As shown in Tables 1 and 2.

CONCLUSIONS: Treatments that included SCALA as a preharvest spray significantly reduced rot by *Botrytis* and *Penicillium* after six months storage (Table 1). No other treatments significantly reduced *Penicillium* rot over the check. After four and six months storage treatments that included VANGARD as a preharvest spray were also very effective in reducing *Botrytis* decay. Other statistically significant differences evident at four months storage for the reduction of Botrytis decay were not evident after six months storage. Postharvest treatment with ELEVATE significantly reduced *Botrytis* decay, but had no effect on *Penicillium* decay (Table 2). Subsequently it was determined that the *Penicillium* isolate used was resistant to benomyl.

Table 1. Effect of bloom or preharvest sprays on postharvest decay of wounded, *Botrytis* or *Penicillium* sp. inoculated Jonagold apples after four or six months air storage.

Treatment, Timing and Rate				Mean rot diameter , mm		
Bloom	Rate	Preharvest	Rate	*Botrytis* 4 months	*Botrytis* 6 months	*Penicillium* 6 months
Check				45.0 e[1]	25.0 de	23.9 b
SOVRAN	300 g/ha			31.8 cd	27.0 e	23.8 b
VANGARD	370 g/ha			24.7 bc	25.5 de	19.5 b
BENLATE MAESTRO	1.1 kg/ha 3.3 kg/ha			36.4 de	24.0 cde	24.3 b
SOVRAN	300 g/ha	SOVRAN	300 g/ha	18.7 b	26.1 de	24.4 b
VANGARD	370 g/ha	BENLATE	1.1 kg/ha	22.6 bc	23.0 c	23.3 b
BENLATE MAESTRO	1.1 kg/ha 3.3 kg/ha	VANGARD	370 g/ha	4.0 a	8.1 b	21.4 b
BENLATE MAESTRO	1.1 kg/ha 3.3 kg/ha	SCALA	2 L/ha	4.6 a	5.6 a	10.8 a
		SCALA	2 L/ha	4.8 a	4.0 a	9.0 a

[1] Numbers followed by the same letter are not statistically different at the p=.05 level.

Table 2. Effect of postharvest treatments on decay of wounded, *Botrytis* or *Penicillium* sp. inoculated Jonagold apples after four or six months air storage.

Treatment	Product rate	Mean rot diameter, mm		
		Botrytis 4 months	*Botrytis* 6 months	*Penicillium* 6 months
Check		24.93 a[1]	23.59 a	21.04 a
MERTECT	0.5 L/1000 L	27.18 a	24.02 a	21.08 a
ELEVATE	1.8 kg/1000 L	10.48 b	4.00 b	18.32 a
1100-6	10^7 CFU[2]/ml	23.00 a	23.56 a	19.27 a

[1] numbers followed by the same letter are not statistically different at the p=.05 level.

[2] CFU is colony forming units.

2000 PMR REPORT # 72
SECTION J: FRUIT - Diseases
STUDY DATA BASE#: 402-1531-8605

CROP: Apples cv. Gala
PEST: Grey mold, *Botrytis cinerea* Pers.
Blue mold, *Penicillium expansum* Link

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TITLE: EVALUATION OF PREHARVEST AND POSTHARVEST FUNGICIDE TREATMENTS FOR CONTROL OF POSTHARVEST DECAY OF GALA APPLES, 1999

MATERIALS: VANGARD 75 WG (cyprodinil), SOVRAN (kresoxim-methyl 50%), MERTECT (thiabendazole 45%), ELEVATE (fenhexamid 50%), *Pseudomonas syringae* strain 1100-6

METHODS: Fungicide treatments at bloom, two weeks preharvest, or bloom and two weeks preharvest were applied to Gala apple trees arranged in a randomized complete block design with four replicate blocks. Each block consisted of four Gala trees with guard Spartan trees on either side. Treatments were an unsprayed check, SOVRAN at 300 g/ha at bloom, VANGARD at 370 g/ha at bloom, VANGARD at 370 g/ha at bloom and preharvest, and VANGARD 370 g/ha preharvest. Spray applications were made with a CO_2 back pack sprayer (207 KPa) to run off. Bloom treatments were applied twice, at pink, May 4, 1999 and at full King bloom, May 14, 1999. Preharvest treatments were applied August 26, 1999. Fruit harvest was September 20, 1999. At harvest, replicate subsamples of apples were selected for postharvest treatments applied September 29, 1999. Post harvest treatments applied as a three minute dip were an untreated check, MERTECT at 0.5 L/1000 L, ELEVATE at 1.8 kg/1000L, and *Pseudomonas syringae* strain 1100-6 at 10^7 colony forming units (CFU)/ml. Treated fruit were stored for four or six months in air storage at 1 ± 0.2 C. Upon removal from storage, five replicates of five fruit were wounded in triplicate, inoculated with 20 l of a *Botrytis* or *Penicillium* spore suspension (10^5 conidia/ml), and incubated at 20 C for five to seven days. Two diameters of developing rot lesions were measured and wound decay data was analyzed using the General Linear Model of SAS. Means were separated using the LSD comparative test.

RESULTS: As shown in Tables 1 and 2.

CONCLUSIONS: No treatment effects were observed after four months storage (Table 1). After six months storage treatments that included VANGARD as a preharvest spray significantly reduced rot by *Botrytis*. The most effective treatment for the control of *Botrytis* decay after six months storage was VANGARD applied at bloom and preharvest. No treatment significantly reduced *Penicillium* rot over the check after six months storage. After four months storage, the post harvest treatments MERTECT, ELEVATE and 1100-6 were effective in reducing postharvest decay by *Botrytis* (Table 2). Postharvest treatment with ELEVATE significantly reduced *Botrytis* decay after six months storage, but had no effect on *Penicillium* decay. Subsequent to the trial it was determined that the *Penicillium* isolate used was benomyl resistant.

Table 1. Effect of bloom or preharvest sprays on postharvest decay of wounded, *Botrytis* or *Penicillium* sp. inoculated Gala apples after four or six months air storage.

Treatment, Timing and Rate				Mean rot diameter , mm		
Bloom	Rate	Preharvest	Rate	*Botrytis* 4 months	*Botrytis* 6 months	*Penicillium* 6 months
Check				5.7 a[1]	18.4 a	22.8 a
SOVRAN	300 g/ha			5.2 a	19.0 a	24.7 a
VANGARD	370 g/ha			7.7 a	17.9 a	26.5 a
		VANGARD	370 g/ha	5.9 a	9.5 b	23.6 a
VANGARD	370 g/ha	VANGARD	370 g/ha	5.3 a	7.0 c	24.3 a

[1] numbers followed by the same letter are not statistically different at p=.05.

Table 2. Effect of postharvest treatments on decay of wounded, *Botrytis* or *Penicillium* sp. inoculated Gala apples after four or six months air storage.

Treatment	Product rate	Mean rot diameter, mm		
		Botrytis 4 months	*Botrytis* 6 months	*Penicillium* 6 months
Check		8.8 a[1]	18.1 a	25.8 a
MERTECT	0.5 L/1000 L	4.8 b	15.5 a	22.8 a
ELEVATE	1.8 kg/1000 L	4.0 b	4.2 b	25.8 a
1100-6	10^7 CFU[2]/ml	6.3 b	19.6 a	23.0 a

[1] numbers followed by the same letter are not statistically different at p=.05.

[2] CFU is colony forming units.

2000 PMR REPORT # 73 **SECTION J: FRUIT - Diseases**
STUDY DATA BASE#: 402-1531-8605

CROP: Apples cv. Braeburn
PEST: Grey mold, *Botrytis cinerea* Pers.
Blue mold, *Penicillium expansum* Link

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDE TREATMENTS FOR CONTROL OF DECAY OF BRAEBURN APPLES, 1999

MATERIALS: MERTECT (thiabendazole 45%), ELEVATE (fenhexamid 50%), *Pseudomonas syringae* strain 1100-6

METHODS: Braeburn apples harvested from each of five locations in the Okanagan Valley were randomly divided into replicate subsamples for postharvest treatments applied October , 1999. Post harvest treatments applied as a three minute dip were an untreated check, MERTECT at 0.5 L/1000 L, ELEVATE at 1.8 kg/1000L, and *Pseudomonas syringae* strain 1100-6 at 10^7 colony forming units (CFU)/ml. Treated fruit were stored for three or six months in air or controlled atmosphere (1.5% CO_2, 1.5% O_2) storage at 1 ± 0.2 C. Upon removal from storage, five replicate samples of five fruit were wounded in triplicate, inoculated with 20 l of a *Botrytis* or *Penicillium* spore suspension (10^5 conidia/ml), and incubated at 20 C for five to seven days. Diameters of developing rot lesions were measured in two directions and wound decay data was analyzed using the General Linear Model of SAS. Means were separated using the LSD comparative test.

RESULTS: as shown in Tables 1 and 2.

CONCLUSIONS: Statistical differences were found in the amount of decay that occurred in fruit from individual locations. Apples stored in CA had statistically less decay. Apples stored for three months were less susceptible to decay than apples stored for six months. The effects of the postharvest treatments were consistent for each location and storage regime. Postharvest treatment with 1100-6 and ELEVATE significantly reduced *Botrytis* decay after three months storage. After six months storage, the MERTECT and ELEVATE treated fruit had significantly less *Botrytis* decay. None of the postharvest treatments reduced *Penicillium* decay. It was subsequently determined that the *Penicillium* isolate used was benomyl resistant.

Table 1. Mean rot diameter of wounded, *Botrytis* inoculated Braeburn apples.

Treatment	Product rate	Mean rot diameter, mm	
		3 months	6 months
Check		21.2 a[1]	30.4 a
MERTECT	0.5 L/1000 L	20.0 a	25.9 b
ELEVATE	1.8 kg/1000 L	5.1 c	14.2 c
1100-6	10^7 CFU[2]/ml	18.6 b	25.5 a

[1] numbers followed by the same letter are not statistically different at p=.05.
[2] CFU is colony forming units.

Table 2. Mean rot diameter of wounded, *Penicillium* inoculated Braeburn apples.

Treatment	Product rate	Mean rot diameter, mm	
		3 months	6 months
Check		9.9 a[1]	25.5 a
MERTECT	0.5 L/1000 L	10.2 a	25.0 a
ELEVATE	1.8 kg/1000 L	10.1 a	25.2 a
1100-6	10^7 CFU[2]/ml	9.7 a	25.5 a

[1] numbers followed by the same letter are not statistically different at p=.05.
[2] CFU is colony forming units.

2000 PMR REPORT # 74 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Apple, cv. Jonagold
PEST: Powdery mildew, *Podosphaera leucotrica* (Ell. and Ev.) Salm.

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TITLE: EFFICACY OF FLINT AGAINST POWDERY MILDEW ON APPLE, 1999

MATERIALS: DITHANE DG 75% (mancozeb), FLINT 50 DF (trifloxystrobin), MAESTRO 75 DF (captan), NOVA 40 WP (myclobutanil), VANGARD 75 WG (cyprodinil)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on twelve-year-old Jonagold apple trees on M7A rootstocks spaced at 3.1 x 6.2 m. Average volume of water applied per tree was 6 litres for a total of 3075 litres per hectare. Treatment quantities for each 100 litres of water were based on these water volumes. Twenty-five trees in two rows were separated into 5 blocks of 5 random single tree replicates per block. The five treatments were applied until run-off with a handgun operated at 860 kPa. Treatments were applied on 15 April (quarter-inch green), 21 April (half-inch green), 28 April (tight cluster to early pink), 11 May (full bloom), 20 May (first cover), 1 June (second cover), 14 June (third cover), 25 June (fourth cover). Primary powdery mildew was assessed on 16 April by counting the total number of white tips on each single tree replicate. Secondary powdery mildew incidence and severity were evaluated on 15 July by rating each leaf on 10 shoots per tree for percent area covered by powdery mildew. Fruit mildew was determined on 16 September by harvesting 20 apples from each single tree replicate and evaluating each fruit for net russeting. These counts were converted to percent infected leaves per tree, mean severity per leaf, and percent russeted fruit. Because the values were proportions they were arcsin-transformed and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range test at p=0.05 was used for multiple comparison of means.

RESULTS: Primary powdery mildew was evenly dispersed throughout the apple orchard averaging 2.1 white tips per tree without significant differences between treatments. Incidence of foliage powdery mildew was equally reduced by all three Novartis treatment regimes and the standard grower program (table 1). Novartis Program #2 reduced the number of powdery mildew infected leaves by 38.7% when compared to the control and was slightly better than the other fungicide treatments. Severity of leaf powdery mildew was lowest for Novartis Program #2 and significantly less severe than Novartis Program #3. All the fungicide treatments significantly reduced russeting of apples due to powdery mildew.

CONCLUSIONS: Treatments containing FLINT were as effective as the grower treatment containing NOVA for powdery mildew control. Novartis Program #2 was the most effective of the three Novartis programs and the standard grower program.

Table 1. Percent incidence and severity of powdery mildew on Jonagold apple leaves and fruit.

Treatment and grams/ 100L water or (Kg/ha)	Foliage Powdery Mildew[1]		Fruit Powdery Mildew[1]
	Incidence	Severity	
MAESTRO (15, 21 Apr) 130.1g (4.0) then NOVA + DITHANE (28 Apr, 12 May) 11.0 g (0.34) + 195.0 g (6.0) then MAESTRO (20 May) 130.1 g (4.0) then NOVA (1 Jun) 11.0g (0.34) then MAESTRO (14, 25 Jun) 130.1 g (4.0) "GROWER PROGRAM"	43.9 b	12.3bc	0.0 b
FLINT (15, 21 Apr) 4.6 g (0.14) then NOVA + DITHANE (28 Apr, 12 May) 11.0 g (0.34) + 195 g (6.0) then MAESTRO (20 May) 130.1g (4.0) then FLINT (1, 14 Jun) 5.7 g (0.18) then MAESTRO (25 Jun) 130.1 g (4.0) "NOVARTIS PROGRAM #1"	45.3 b	8.0 bc	1.1 b
VANGARD (15, 21 Apr) 12.1g (0.37) then FLINT (28 Apr, 11 May) 6.8 g (0.21) then MAESTRO (20 May) 130.1g (4.0) then FLINT (1, 14 Jun) 5.7 g (0.18) then MAESTRO (25 Jun) 130.1 g (4.0) "NOVARTIS PROGRAM #2"	41.6 b	6.8 c	2.9 b
FLINT (15, 21 Apr) 5.7 g (0.18) then FLINT (28 Apr, 11 May) 6.8 g (0.21) then MAESTRO (20 May) 130.1 g (4.0) then NOVA (1 Jun) 11.0 g (0.34) then MAESTRO (14,25 Jun) 130.1 g (4.0) "NOVARTIS PROGRAM #3"	46.7 b	13.2 b	0.0 b
UNTREATED CONTROL	80.3 a	31.8 a	11.0 a
ANOVA P>F	0.0005	0.0002	0.020

[1] The values for foliage mildew incidence and severity are the means of five and four replications, respectively. The values for fruit powdery mildew incidence are the means of five replications. Mildew severity is the average percent mildew covering the leaf surface.
These data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Numbers followed by the same letter are not significantly different at p = 0.05 as decided by the Duncan's Multiple Range Test.

2000 PMR REPORT # 75 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE #: 402-1531-8605

CROP: Apples cv. Jonagold
PEST: Fire blight, *Erwinia amylovora* (Burrill) Winslow et al

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TITLE: CONTROL OF FIRE BLIGHT INFECTION OF APPLE SHOOTS WITH APOGEE IN 2000

MATERIALS: APOGEE (27.5% prohexadione calcium)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C on 33 one year-old Jonagold apple trees on B-9 rootstocks in a screen house. Three treatments were used; control, APOGEE applied once, and APOGEE applied twice. APOGEE was applied with a backpack sprayer at a concentration of 0.37 g/L in 5 litres of water. The first application was made on 8 June, and the second on 30 June. Two shoots on each tree were each injected with 20 L of *E. amylovora* (1 x 10^8 CFU/mL) suspension. The first shoot was inoculated on 15 June and the second one week later on the 23 June. Shoots displaying symptoms of fire blight as indicated by blackened leaf midveins, twisted and wilted leaves, and browning of leaf tips were recorded on 30 June and 25 July. At the same time the shoot lengths were recorded. The trees grown in 2 gallon pots were fertilized with Osmocote and 20-20-20 from 28 April to 4 July for a total of 4 g of actual nitrogen, phosphorus, and potassium. Fire blight incidence was converted to percent infected shoots per tree, and the arcsin-transformed data were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). Recorded shoot lengths were also analyzed with the GLM Procedure. The Least Significant Difference (LSD) test was used for multiple comparison of means of fire blight incidence and shoot length.

RESULTS and DISCUSSION:

Shoot blight caused by inoculating *E. amylovora* directly into the shoot was reduced to zero by one application of APOGEE on rapidly growing Jonagold shoots (Table 1). The suppression of shoot blight lasted for the duration of the experiment, from mid June until late July. APOGEE significantly reduced shoot growth approximately six weeks after it was applied (Table 2). Control shoots were approximately 14 mm shorter than those treated with APOGEE. It appears that APOGEE suppresses fire blight induced shoot blight by reducing shoot growth. It is likely that naturally infected shoots of apple would also be controlled by this treatment. However shoot growth would also be reduced so this treatment would not be advantageous to all growers who wish to control fire blight. It would be an excellent treatment where both fire blight and shoot growth need to be controlled such as in mature super spindle plantings.

CONCLUSION:

APOGEE at the 37.0 g per 100 L rate is an effective material for suppressing shoot blight on Jonagold apple trees.

Table 1. Percent Jonagold apple shoots blighted by *Erwinia amylovora*.

Treatment	Rate/100L water	Shoot Blight[1]	
		30 June	25 July
Control	not applicable	31.3 a[2]	40.3 a
APOGEE 1 application	37 grams	00.0 b	00.0 b
APOGEE 2 applications	37 grams	09.1 b	13.5 b
Least Sig. Difference		1.7	4.0
ANOVA Pr>F		0.0012	0.0072

[1] These values are means of 11 replications for 2 shoots per Jonagold tree.

[2] Numbers followed by the same letter are not significantly different at p 0.05 according to the LSD Test. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here.

Table 2. Length of Jonagold apple shoot treated with APOGEE.

Treatment and Rate (g/100 L water)	Average Shoot Length (mm)[1]			
	13 June	30 June	12 July	25 July
Control	66.4 ab[2]	86.3 a	88.6 a	103.9 a
APOGEE 1 application 37 g	63.0 b	78.3 a	77.0 a	087.4 b
APOGEE 2 applications 37g	75.2 a	86.6 a	86.3 a	087.3 b
Least Sig. Differ.	11.4	17.5	14.8	15.9
Pr>F	00.0758	00.5519	00.2544	00.0652

[1] These values are average shoot length of two shoots per tree replicated 11 times.

[2] Numbers followed by the same letter are not significantly different at p 0.05 according to the LSD Test. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here.

2000 PMR REPORT # 76 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 390 1252 9201

CROP: Highbush Blueberry (*Vaccinium corymbosum*)
PEST: Fruit rots, *Colletotrichum gloeosporioides, Botrytis cinerea*

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TITLE: **EFFICACY OF FUNGICIDES FOR THE CONTROL OF FRUIT ROT IN HIGHBUSH BLUEBERRIES IN 2000.**

MATERIALS: MAESTRO 75 DF (captan), ELEVATE 50 WDG (fenhexamid), STROBY 50 DF (kresoxim-methyl), SWITCH 65.2 WG (cyprodinil +fludioxonil), ALIETTE 80 WP (fosetyl-al), QUADRIS 80 WG (azoxystrobin).

METHODS: The trial was conducted in 2000 in a commercial blueberry planting at Abbotsford, B.C. in a field known to be infected with fruit rot. Plants were spaced 1.3 m apart within the row. Each treatment was applied to 3.9 m x 2 m plots (3 bushes) replicated four times in a randomized complete block. Only the middle bush within each plot was assessed. Two untreated bushes at either end of each plot were left as a buffer between each treatment. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 1000L/ha of water at a pressure of 350 kPA. MAESTRO, ELEVATE, STROBY, SWITCH and QUADRIS were each applied four times on April 29 (5% blossom stage), May 8 (30% blossom stage), May 15 (80% blossom stage) and June 1 (100% blossom stage and some fruit set). MAESTRO followed by ALIETTE followed by MAESTRO followed by ALIETTE followed by MAESTRO was applied April 29, May 8, May 15, June 1 and June 19 (complete fruit set). Harvest began on July 24 and continued until August 28. At each picking, marketable, rot and cull weights were recorded. Size index based on the gram weight of 50 marketable berries was also recorded at each picking. Two postharvest fruit rot trials were set up. In both, twenty randomly picked berries from the marketable yield were placed on styrofoam plates covered with damp paper towels. The plates were then covered with plastic wrap. In one trial the prepared plates were left at ambient temperature and rots counted approximately 10 days later. The other set was put in cold storage at 2 C for approximately two weeks and then stored at ambient temperature for approximately one week before rots were counted. The main postharvest rot that developed was *Colletotrichum gloeosporioides* with some *Botrytis cinerea* and the odd *Alternaria sp* and *Rhizopus sp*. Data were analysed with the general linear models procedure (SAS institute, Cary, NC) and means were separated using the Duncan's Multiple Range Test.

RESULTS: Data are presented in Tables 1, 2 and 3. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Size index was not detrimentally affected by any treatment. Field rot, which was caused by *Colletotrichum gloeosporioides*, was reduced by MAESTRO, MAESTRO alternated with ALIETTE, SWITCH AND QUADRIS. In the storage trials *Colletotrichum gloeosporioides* was the main rot with some *Botrytis cinerea*. Less *Colletotrichum gloeosporioides* developed in the berries that were placed in cold storage. In both postharvest trials, MAESTRO, MAESTRO alternated with ALIETTE, SWITCH and QUADRIS reduced *Collectotrichum gloeosporiodes*. Both rates of QUADRIS were more effective than any other treatment in reducing *Colletotrichum gloeosporioides*. The higher rate was more efficient at reducing anthracnose, especially later in the harvest period.

Table 1. Marketable weight, rot weight, size index and percentage field rot of blueberries.

Treatment	Rate (g ai/ha)	No of Appn [1]	Marketable Weight (grams/m^2)	Rot Weight (grams/m^2)	Size Index (grams/m^2)	% Rot
CHECK	-	-	2273 b [2]	41.5 a	54.9 ab	1.7 a
MAESTRO	2500	4	2380 ab	13.1 c	58.6 ab	0.5 bc
ELEVATE	550	4	1997 b	39.4 ab	50.8 b	1.9 a
ELEVATE	850	4	2651 ab	34.5 abc	59.7 ab	1.3 ab
MAESTRO [3] fb ALIETTE fb MAESTRO fb ALIETTE fb MAESTRO	2500 5500 2500 5500 2500	1 1 1 1 1	2544 ab	20.3 abc	58.4 ab	0.8 bc
STROBY	100	4	3066 ab	41.8 a	61.6 ab	1.3 ab
SWITCH	625	4	3507 a	30.0 abc	62.8 ab	0.8 bc
QUADRIS	280	4	3059 ab	9.2 c	65.6 a	0.3 c
QUADRIS	560	4	2831 ab	8.2 c	58.1 ab	0.3 c

[1] No of Appn = number of applications.

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[3] fb = followed by.

Table 2. Percentage of berries infected by *Colletotrichum gloeosporioides* after being stored at ambient temperature following harvest.

Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 24 Aug 02 [2]	Jul 31 Aug 07	Aug 08 Aug 15	Aug 14 Aug 23	Aug 21 Aug 28	Aug 28 Sept 06
CHECK	-	-	85.8 ab[3]	86.3 a	80.0 a	78.3 a	98.3 a	82.5 a
MAESTRO	2500	4	95.0 a	40.0 c	36.3 bcd	33.8 d	46.7 de	61.3 ab
ELEVATE	550	4	96.7 a	78.8 ab	47.5 bc	85.0 a	81.3 ab	80.0 a
ELEVATE	850	4	92.5 a	81.3 ab	61.3 ab	62.5 b	75.0 abc	68.8 ab
MAESTRO[4]	2500	1	61.3 b	62.5 b	33.8 bcd	47.5 cd	52.5 cd	70.0 ab
fb ALIETTE	5500	1						
fb MAESTRO	2500	1						
fb ALIETTE	5500	1						
fb MAESTRO	2500	1						
STROBY	100	4	81.3 ab	66.3 ab	53.8 ab	52.5 bc	60.0 bcd	47.5 bc
SWITCH	625	4	62.5 b	70.0 ab	38.8 bc	45.0 cd	71.3 bcd	80.0 a
QUADRIS	280	4	61.3 b	12.5 d	10.0 d	16.3 e	25.0 ef	32.5 c
QUADRIS	560	4	20.0 c	12.5 d	20.0 cd	8.8 e	7.5 f	7.5 d

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[1] No of Appn = number of applications.

[2] First date: set up, second date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by.

Table 3. Percentage of berries infected by *Colletotrichum gloeosporioides* after being stored in cold storage then at ambient temperature following harvest.

Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 24 Aug 08 Aug 15[2]	Jul 31 Aug 16 Aug 23	Aug 08 Aug 22 Aug 28	Aug 14 Aug 30 Sept 07	Aug 21 Sept 06 Sept 14	Aug 28 Sept 13 Sept 21
CHECK	-	-	70.0 a[3]	76.3 a	50.0 ab	51.3 ab	77.5 a	75.0 abc
MAESTRO	2500	4	35.0 bc	38.8 c	23.8 cd	17.5 cd	32.5 cd	57.5 cde
ELEVATE	550	4	63.3 a	68.8 ab	58.3 a	52.5 a	80.0 a	83.8 a
ELEVATE	850	4	75.0 a	70.0 ab	60.0 a	30.0 abc	62.5 ab	81.3 ab
MAESTRO[4]	2500	1	28.8 bc	41.3 c	38.8 bc	21.3 cd	45.0 bc	63.8 bcd
fb ALIETTE	5500	1						
fb MAESTRO	2500	1						
fb ALIETTE	5500	1						
fb MAESTRO	2500	1						
STROBY	100	4	52.5 ab	57.5 b	46.3 ab	41.3 abc	65.0 ab	53.8 de
SWITCH	625	4	31.3 bc	33.3 c	36.3 bc	27.5 bc	48.8 bc	67.5 a-d
QUADRIS	280	4	12.5 c	15.0 d	13.8 de	2.5 d	12.5 de	40.0 e
QUADRIS	560	4	13.8 c	8.8 d	3.8 e	2.5 d	5.0 e	7.5 f

[1] No of Appn = number of applications.

[2] First date: set up, second date: berries taken out of storage, third date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by.

2000 PMR REPORT # 77 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Sweet cherry (*Prunus avium)*
PEST: Brown rot, *Monilinia fructicola* (Wint.) Honey

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TITLE: USE OF ELEVATE FOR CONTROL OF BROWN ROT OF SWEET CHERRIES IN 1999

MATERIALS: ELEVATE 50 WDG (fenhexamid), MAESTRO 75 WDG, (captan), ROVRAL 50 WP (iprodione)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. in an orchard block consisting of 20 mature (approx. 40 year-old) sweet cherry trees spaced 6.1 x 4.9 m. The average amount of water applied per hectare (320 trees) based on 10.0 litres per tree was 3200 litres. The experimental design was a randomized complete block with treatments replicated four times on single tree replicates. The treatments were applied until run-off with a handgun operated at 860 kPa on 15 April (white bud), 25 April (full bloom), 7 May (petal fall), 22 June (5 weeks after petal fall), 2 July (ripening cherry) and 27 July (1 day before harvest). After the full bloom spray, one shoot from each tree was collected, placed in the greenhouse, and misted with approx. 1.0 x 10^5 conidia/mL of *Monilinia fructicola* on April 26. Ten blossoms per shoot were examined for infection by *M. fructicola* with the aid of a dissecting microscope approx. 1 week after the blossoms were placed in the greenhouse. Number of blighted blossoms were counted on 3 June by visually examining each tree for withered blossoms. Fruit brown rot was assessed at harvest on 28 July by evaluating all the fruit per tree for brown rot. Shelf-life of the fruit was assessed by inoculating 200 fruit with *M. fructicola* (1.0 x 10^5 conidia/mL) at harvest. One hundred of these fruit were incubated at 1 C for 11 days and the other 100 fruit were incubated at 20 C for 5 days after which rot was recorded. These values were converted to percent infected fruit and the arcsin transformed values were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range test was used for multiple comparison of means and the detransformed means are reported.

RESULTS: Only MAESTRO was effective in preventing cherry blossom infection by not allowing any blossoms to become infected in the greenhouse. ELEVATE at the low and high rate was no more effective than the ROVRAL standard which allowed 22.5% infection (Table 1). Blossom blight only occurred on a few trees indicating that conditions were not conducive to its presence this growing season. Fruit brown rot was not present at harvest even though the fruit were harvested at least two weeks later than the normal harvest date. Fruit stored at 1 C for 11 days developed very little brown rot. However, significantly less brown rot than the control developed in the MAESTRO and high rate of ELEVATE. Fruit stored at 20 C for 5 days developed heavy brown rot resulting in 64.0% infection in the control. All the treatments were equally effective in reducing brown rot to 2.5% or lower.

CONCLUSIONS: MAESTRO is a very effective fungicide for preventing blossom infection of cherries. ELEVATE at the low rate is as effective as ROVRAL in preventing cherry fruit rot caused by *M. fructicola.*

Table 1. Brown rot of cherry blossoms and fruit stored for 11 and 5 days, at 1 and 20 C respectively.

Treatment	Rate of Product /100L (kg/ha)[1]	Blossoms infected (%)	Brown rotted fruit at 1 C (%)	Brown rotted fruit at 20 C (%)
CHECK	—	35.0 a[2]	6.8 a	64.0 a
ELEVATE	36.4 g (1.2 kg/ha)	30.0 a	4.0 ab	01.5 b
ELEVATE	56.2 g (1.8 kg/ha)	27.5 a	2.8 b	01.5 b
MAESTRO	132.3 g (4.2kg/ha)	00.0 b	2.2 b	01.5 b
ROVRAL	57.9 g (1.8 kg/ha)	22.5 a	4.5 ab	02.5 b
ANOVA Pr > F		0.10	0.07	0.002

[1] The kg/ha rate is based on an average volume of 10 litres of water per tree. Actual volumes varied from 10 to 12.5 litres per tree.

[2] These values are means of four replications. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P 0.05).

2000 PMR REPORT # 78 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 390 1252 9201

CROP: Grape, cv. Madeline Sylvaner
PEST: Powdery mildew, *Uncinula necator*

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TITLE: THE USE OF CLAY FOR POWDERY MILDEW CONTROL IN GRAPE PLANTS

MATERIALS: IRONWOOD MINERALL CLAY (glacial marine clay)

METHODS: The trial was conducted at the Domaine de Chaberton Estate Winery grape field in South Langley. The grape planting was eight years old. Plots were 9 m long, and contained 5 to 6 well established grape plants. There were 4 replicates in a randomized block design. Two applications of sulphur had been applied prior to the start of the trial. Spray treatments included water (control), 10 g Ironwood MinerAll clay/L of water and 40 g Ironwood MinerAll clay/L of water. The treatments were applied using a CO2 pressurized sprayer at 415 Kpa in 500 ml of water per plot. A total of 8 sprays were applied on June 12, 25, July 2, 14, 22, Aug 6, 21 and September 7, 1997.

Weather in mid-July to the end of August was warm and dry. Powdery mildew did not appear until mid September. Counts of leaves infected with powdery mildew and leaf chlorophyll readings were taken on September 24 and October 16, 1997. Chlorophyll measurements were taken with a Minolta Chlorophyll Meter SPAD-502 and were based on the average of 30 leaves on each side of the row, east and west.

RESULTS: The Ironwood MinerAll clay treatments reduced the number of leaves infected with powdery mildew on both the assessment dates.

CONCLUSION: Ironwood MinerAll clay can be used to reduce powdery mildew in grape plantings without any detrimental effect on the chlorophyll content of the leaves. The chlorophyll readings were actually slightly elevated in the treated plots.

Table 1. Evaluation of clay for the control of powdery mildew and its effect on chlorophyll readings on September 24, 1997.

Treatment	Rate (g /L)	Number of leaves infected with Powdery Mildew	Chlorophyll readings west side (SPAD[1])	Chlorophyll readings east side (SPAD)	Chlorophyll readings average (SPAD)
Control-water	-	10.0 a[2]	28.9 b	31.5 c	30.2 c
Clay	10	4.5 b	30.5 a	33.1 b	31.8 a
Clay	40	2.3 b	30.4 ab	34.8 a	31.1 bc

[1] SPAD values are values defined by Minolta which indicate the relative amount of chlorophyll present in plant leaves.

[2] Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Evaluation of clay for the control of powdery mildew and its effect on chlorophyll readings on October 16, 1997.

Treatment	Rate (g /L)	Number of leaves infected with Powdery Mildew	Chlorophyll readings west side (SPAD[1])	Chlorophyll readings east side (SPAD)	Chlorophyll readings average (SPAD)
Control-water	-	59.0 a[2]	26.2 a	30.2 a	28.2 b
Clay	10	22.7 b	27.0 a	32.4 a	29.7 a
Clay	40	32.0 b	27.6 a	32.6 a	30.1 a

[1] SPAD values are values defined by Minolta which indicate the relative amount of chlorophyll present in plant leaves.

[2] Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

2000 PMR REPORT # 79 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Chancellor
PEST: Powdery mildew, *Uncinula necator* (Schwein) Burrill

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TITLE: EFFICACY OF FLINT AGAINST POWDERY MILDEW ON GRAPE, 1999

MATERIALS: ABOUND FLOWABLE (22.9% azoxystrobin), NOVA 40W (myclobutanil), ROVRAL 50W (iprodione), KUMULUS (sulphur), DITHANE 75 DF (mancozeb), MAESTRO 75 DF (captan), FLINT 50 DF (trifloxystrobin)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 9 year old vines. Spacing was 3.6 x 7.2 m for a panel of 3 grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with five replicates. Each 3-vine replicate had one half of vines 1 and 3 as guards for disease evaluation, thus treatments were separated by 2 half-vine buffers. The two treatments were applied until run-off with a handgun operated at approximately 860 kPa at a rate of 1000L water/ha. Treatments were applied on 21 May (1-5 cm shoot), 3 June (10-15 cm shoot), 10 June (20-30 cm shoot), 17 June (Prebloom), 30 June (Postbloom), 20 July (First Cover), 3 August (Second cover), 24 August (Third cover), 17 September (Fourth cover), 5 October (Fifth cover). See below for application times and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 26 August, by examining ten leaves on each of four shoots per vine, and on 10 berry clusters per three vines. This was repeated on 14 October when infection of canes was also determined by visually examining five internodes on each of three canes per vine and estimating percent infection. At harvest on 21 October, yield, number of clusters and number of clusters with bunch rot were recorded. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. A 50 g subsample from each sample of 100 berries from randomly selected clusters in each replicate were subjected to a nonvolatile acid extraction procedure and titratable acidity was determined on the obtained extracts using a Brinkmann Titroprocessor ensemble. The rest of the sample was juiced, and soluble solids concentration (Brix), and pH were measured on settled juice using an Abbé refractometer and a pH meter, respectively. Counts of cluster, leaf, and cane powdery mildew and bunch rot were converted to the percent infected per replicate and arcsin-transformed. Number of clusters, yield, BRIX, pH, titratable acidity and the transformed data for leaf, cane, and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range Test was used to separate means (P = 0.05).

Grower Program consisted of Dithane 75 DF (450 g/100 L) on 21 MAY; Maestro 75 W (350 g/100 L) on 3 JUN; Dithane 75 DF (450 g/100 L) on 10 JUN; Nova and Maestro (20 g + 350 g/100 L) on 17 JUN; Nova and Maestro (20 g + 350 g/ 100 L) on 30 JUN; Nova and Maestro (20 g + 350 g/ 100 L) on 20 JUL; Rovral and Kumulus (150 g + 300 g/100 L) on 3 AUG; Nova and Rovral (20.0 g + 150 g/100 L) on 24 AUG; Nova and Rovral (20.0 g + 150 g/100 L) on 17 SEP; Maestro + Kumulus (350g/100 L +300g/100L) on 5 OCT; Harvest on 21 OCT.

Novartis Program consisted of Dithane 21 May (450 g/100 L); Flint 3 JUN (14g/100); Dithane 10 JUN; Flint + Maestro 17 JUN (14 g/100L + 350 g/100L); Flint + Maestro 30 JUN (14 g/100L + 350 g/100L); Nova + Maestro 20 JUL (20 g/100L + 350 g/100L); Rovral + Kumulus 3 Aug (150 g/ 100L + 300g/100L); Flint 24 AUG (14 g/100L); Nova + Maestro 17 SEP (20 g/100L + 350 g/100L); Flint 5 OCT (14 g/ 100L); Harvest 21 OCT.

Zeneca Program consisted of Dithane 21 May (450 g/100 L); Abound 3 JUN (100 mL/100); Dithane 10 JUN; Abound 17 JUN (100 mL/100L); Abound 30 JUN (100 mL/100L) Nova + Maestro 20 JUL (20 g/100L + 350 g/100L); Rovral + Kumulus 3 Aug (150 g/ 100L + 300g/100L); Abound 24 AUG (100 mL/100L); Abound 17 SEP (100 mL/100L); Maestro + Kumulus 5 OCT (350 g/ 100L + 300 g/100L); Harvest 21 OCT.

RESULTS: Incidence and severity of leaf powdery mildew on 26 August was not significantly different between the three programs which all reduced powdery mildew to very low levels (Table 1). Foliage mildew was higher in all treatments on 14 October and it was not possible to determine any significant differences between treatments. Incidence of berry cluster mildew was less for the Zeneca and Grower programs compared to the Novartis program on 26 August, although there was no significant differences between the programs for severity (Table 2). However, Incidence and severity of the treated grapes among all programs was significantly less than the control on 14 October, just before harvest. None of the treatments significantly reduced incidence of cane powdery mildew although all three programs significantly reduced severity of the cane powdery mildew (Table 3). Grape bunch rot was not significantly reduced by any of these treatments at harvest although very little bunch rot occurred. Yield or weight of fruit per program was greater than in the control. Number of clusters per treatment were not significantly different. BRIX, pH, and titratable acidity were not significantly different between the grower standard program and the Novartis program (Table 4).

CONCLUSIONS: The Novartis, Grower, and Zeneca programs were very effective in preventing cluster powdery mildew at harvest and therefore would prevent economic loss to the grape grower. They all reduced foliage powdery mildew during the early and middle part of the growing season when it could effect yield. They all reduced the severity of cane powdery mildew. The programs had no significant effect on bunch rot, number of clusters, BRIX, pH, and titratable acidity. They all increased yield of grapes over the untreated control.

Table 1. Percent powdery mildew on leaves of Chancellor grapes.

Treatment Program	26 August, 1999		14 October, 1999	
	Incidence	Severity	Incidence	Severity
Control	25.7 a[1]	5.84 a	56.0 a	22.0 a
Grower	04.3 b	0.54 b	28.5 a	07.4 a
Zeneca	01.0 b	0.08 b	35.0 a	10.4 a
Novartis	01.8 b	0.10 b	30.8 a	10.4 a
ANOVA TRT P>F	0.001	0.003	0.218	0.480

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 2. Percent powdery mildew on fruit clusters of Chancellor grapes.

Treatment Program	26 August, 1999		14 October, 1999	
	Incidence	Severity	Incidence	Severity
Control	100.0 a[1]	32.5 a	50.0 a	13.8 a
Grower	006.0 bc	00.3 b	02.0 b	00.1 b
Zeneca	002.0 c	00.1 b	00.0 b	00.0 b
Novartis	032.0 b	04.3 b	02.0 b	00.1 b
ANOVA TRT P>F	0.0001	0.0001	0.0001	0.0006

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 3. Percent cane powdery mildew and bunch rot, number of clusters, and weight at harvest of Chancellor grapes.

Treatment Program	Cane Powdery Mildew		Bunch Rot	Number of Clusters	Weight (kg)
	Incidence	Severity			
Control	42.7 a[1]	23.9 a	5.0 a	177.2 a	15.0 b
Grower	14.7 a	01.4 b	4.0 a	189.8 a	20.6 ab
Zeneca	09.3 a	00.5 b	2.0 a	232.2 a	31.1 ab
Novartis	08.0 a	00.4 b	6.7 a	226.7 a	34.0 a
ANOVA TRT P>F	0.156	0.030	0.920	0.658	0.080

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 4. BRIX, pH, and titratable acidity of Chancellor grapes at harvest on 21 October, 1999.

Treatment Program	% BRIX	pH	Titratable Acidity
Grower	20.04 a[1]	3.21 a	18.94 a
Novartis	19.70 a	3.14 a	19.28 a
ANOVA TRT P>F	0.245	0.417	0.592

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

2000 PMR REPORT # 80 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Chancellor
PEST: Powdery mildew, *Uncinula necator* (Schwein) Burrill

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TITLE: EFFICACY OF QUINOXYFEN AGAINST POWDERY MILDEW ON GRAPE, 1999

MATERIALS: NOVA 40W (myclobutanil), ROVRAL 50W (iprodione), KUMULUS (sulphur), DITHANE 75 DF (mancozeb), MAESTRO 75 DF (captan), Quinoxyfen 250 g/L

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 15 year old vines. Spacing was 3.6 x 7.2 m for a panel of 3 grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with five replicates. Each 3-vine replicate had one half of vines 1 and 3 as guards, thus treatments were separated by 2 half-vine buffers for powdery mildew evaluation. The six treatments were applied until run-off with a handgun operated at approximately 860 kPa at a rate of 1000L water/ha. Treatments were applied on 21 May (1-5 cm shoot), 3 June (10-15 cm shoot), 10 June (20-30 cm shoot), 17 June (Prebloom), 30 June (Postbloom), 20 July (First Cover), 3 August (Second cover), 24 August (Third cover), 17 September (Fourth cover), 5 October (Fifth cover). See below for application times and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 26 August, by examining ten leaves on each of four shoots per vine, and on 10 berry clusters per three vines. This was repeated on 14 October when infection of canes was also determined by visually examining five internodes on each of three canes per vine and estimating percent infection. At harvest on 21 October, yield, number of clusters and number of clusters with bunch rot were recorded. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. A 50 g subsample from each sample of 100 berries from randomly selected clusters in each replicate were subjected to a nonvolatile acid extraction procedure and titratable acidity was determined on the obtained extracts using a Brinkmann Titroprocessor ensemble. The rest of the sample was juiced, and soluble solids concentration (Brix), and pH were measured on settled juice using an Abbé refractometer and a pH meter, respectively. Counts of cluster, leaf, and cane powdery mildew and bunch rot were converted to the percent infected per replicate and arcsin-transformed. Number of clusters, yield, BRIX, pH, titratable acidity and the transformed data for leaf, cane, and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range Test was used to separate means ($P = 0.05$).

Grower Program consisted of Dithane 75 DF (450 g/100 L) on 21 MAY; Maestro 75 W (350 g/100 L) on 3 JUN; Dithane 75 DF (450 g/100 L) on 10 JUN; Nova and Maestro (20 g + 350 g/ 100 L) on 17 JUN; Nova and Maestro (20 g + 350 g/ 100 L) on 30 JUN; Nova and Maestro (20 g + 350 g/ 100 L) on 20 JUL; Rovral and Kumulus (150 g + 300 g/100 L) on 3 AUG; Nova and Rovral (20.0 g + 150 g/100 L) on 24 AUG; Nova and Rovral (20.0 g + 150 g/100 L) on 17 SEP; Maestro + Kumulus (350g/100 L +300g/100L) on 5 OCT; Harvest on 21 OCT.

Quinoxyfen Program (low, medium, and high rate) consisted of Dithane 75 DF (450 g/100 L) on 21 MAY; Maestro 75 W (350 g/100 L) on 3 JUN; Dithane 75 DF (450 g/100 L) on 10 JUN; Nova and Maestro (20 g + 350 g/ 100 L) on 17 JUN; Quinoxyfen and Maestro (8 mL (low rate), 24 mL (medium rate), or 48 mL (high rate)+ 350 g/ 100 L) on 30 JUN; Quinoxyfen and Maestro (8 mL (low rate), 24 mL (medium rate), or 48 mL (high rate)+ 350 g/ 100 L) on 20 JUL; Rovral and Kumulus (150 g + 300 g/100 L) on 3 AUG; Quinoxyfen and Rovral (8 mL (low rate), 24 mL (medium rate), or 48 mL (high rate)+ 150 g/ 100 L) on 24 AUG; Quinoxyfen and Rovral (8 mL (low rate), 24 mL (medium rate), or 48 mL (high rate)+ 150 g/ 100 L) on 17 SEP; Maestro + Kumulus (350g/100 L +300g/100L) on 5 OCT; Harvest on 21 OCT.

RESULTS: According to the Gubler model for grape powdery mildew, ascospore infection would have occurred on 21 June with the powdery mildew index being triggered on 10 July. Foliage mildew was first noticed in late July on control leaves. The index remained high for powdery mildew throughout the season. All three rates of quinoxyfen were as effective as the grower standard in reducing the incidence and severity of powdery mildew to very low levels near veraison. Later on the effect was not as pronounced and it was not possible to measure significant differences between the treatments. Cluster powdery mildew occurred on all the control grape clusters on 26 August. The most effective treatments were the grower program and the medium rate of quinoxyfen. Later in the year all rates of quinoxyfen and the grower program reduced cluster powdery mildew to very low levels. The high rate of quinoxyfen appeared to be the most effective treatment reducing cluster powdery mildew to zero. Quinoxyfen also reduced the occurrence of cane powdery mildew although the values were extremely variable. Quinoxyfen had no significant effect on percent clusters with bunch rot or total number of clusters. Harvested weight of grapes per treatment was significantly higher for the medium rate of quinoxyfen than the untreated control. There was no apparent signs of phytotoxicity in grapes leaves, fruit, or canes sprayed with quinoxyfen. It did not produce any significant differences in BRIX, pH, and titratable acidity when compared to the grower standard.

CONCLUSIONS: Quinoxyfen is an effective fungicide for the control of powdery mildew of grapes in British Columbia at relatively low rates. It was more effective at the medium and high rates in controlling cluster powdery mildew.

Table 1. Percent powdery mildew on leaves of Chancellor grapes treated with QUINOXYFEN.

Treatment Program	26 August, 1999		14 October, 1999	
	Incidence	Severity	Incidence	Severity
Control	25.7 a[1]	5.8 a	56.0 a	22.0 a
Grower	4.3 b	0.5 b	28.5 a	7.4 a
Quin. low rate	5.3 b	0.4 b	27.0 a	7.2 a
Quin. med. rate	1.8 b	0.1 b	30.8 a	6.0 a
Quin. high rate	0.8 b	0.1 b	33.5 a	12.1 a
ANOVA TRT P>F	0.003	0.002	0.212	0.413

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 2. Percent powdery mildew on fruit clusters of Chancellor grapes treated with QUINOXYFEN.

Treatment Program	26 August, 1999		14 October, 1999	
	Incidence	Severity	Incidence	Severity
Control	100.0 a[1]	32.5 a	50.0 a	13.8 a
Grower	006.0 c	00.3 c	02.0 b	00.1 b
Quin. low rate	036.0 b	05.6 b	04.0 b	00.4 b
Quin. med. rate	012.0 c	00.8 bc	10.0 b	00.5 b
Quin. high rate	018.9 bc	01.4 bc	00.0 b	00.0 b
ANOVA TRT P>F	0.0001	0.0001	0.001	0.001

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 3. Percent cane powdery mildew and bunch rot, number of clusters, and weight at harvest of Chancellor grapes treated with QUINOXYFEN.

Treatment Program	Cane Powdery Mildew		Bunch Rot	Number of Clusters	Weight (kg)
	Incidence	Severity			
Control	42.7 a[1]	23.9 a	5.0 a	177.2 a	15.0 b
Grower	14.7 ab	01.4 b	4.0 a	189.8 a	20.6 ab
Quin. lo rate	01.3 b	00.1 b	0.0 a	213.8 a	21.4 ab
Quin. me rate	29.3 ab	03.0 b	0.0 a	194.2 a	31.7 a
Quin. hi rate	14.0 ab	01.2 b	0.0 a	187.0 a	25.1 ab
ANOVA TRT P>F	0.107	0.026	0.460	0.977	0.095

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 4. BRIX, pH, and titratable acidity of Chancellor grapes at harvest on 21 October, 1999.

Treatment Program	% BRIX	pH	Titratable Acidity
Grower	20.0 a[1]	3.21 a	18.9 a
Quin. low rate	20.0 a	3.20 a	20.3 a
Quin. medium rate	19.8 a	3.18 a	18.9 a
Quin. high rate	20.1 a	3.13 a	18.7 a
ANOVA TRT P>F	0.964	0.282	0.302

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

2000 PMR REPORT # 81 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Pinot noir
PEST: Bunch rot, *Botrytis cinerea* Pers.:Fr.

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TITLE: EFFICACY OF SCALA APPLIED EARLY AND LATE AGAINST BUNCH ROT OF GRAPE, 1999

MATERIALS: ROVRAL 50W (iprodione), SCALA 400 SC (pyrimethanil 400 g/L)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 15 year old vines. Spacing was 1.4 x 3.6 m for a panel of 5 grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with five replicates. Each 5-vine replicate had vines 1 and 5 as guards for disease evaluation, thus treatments were separated by a 2 vine buffer on each side. The treatments were applied until run-off with a handgun operated at approximately 860 kPa at a rate of 1000L water/ha. Treatments were applied on 18 June (Prebloom), 6 July (Postbloom), 6 August (Berry touch), 27 August (Cluster closure), 21 September (Veraison), 5 October (Preharvest). See below for application times and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 26 August, by examining ten leaves on each of four shoots per vine in the three middle vines, and on 10 berry clusters per three middle vines. This was repeated on 14 October when infection of canes was also determined by visually examining five internodes on each of three canes per vine and estimating percent infection. At harvest on 21 October, yield, number of clusters and number of clusters with bunch rot were recorded. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. Counts of cluster, leaf, and cane powdery mildew and bunch rot were converted to the percent infected per replicate and arcsin-transformed. The transformed data for leaf, cane, and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range Test was used to separate means ($P = 0.05$).

Standard Program consisted of ROVRAL 50 W (150 g/100 L or 1.5 kg/ha) on 18 June, 6 July, 27 August, 21 September. Harvest on 21 October.

AgrEvo Early Program consisted of SCALA 400 SC (200 mL/100 L or 2.0 L/ha) on 18 June, 6 July, 27 August, and 21 September. Harvest on 21 October.

AgrEvo Late Program consisted of SCALA 400 SC (200mL/100L or 2.0 L/ha) on 6 July, 6 August, 21 September, and 5 October. Harvest on 21 October.

RESULTS: SCALA applied early, or 14 days before harvest controlled bunch rot as well as the ROVRAL standard (Table 1). As expected the SCALA and ROVRAL treatments did not significantly reduce powdery mildew incidence on grape leaves (Table 2). However, the treatments did somewhat reduce the incidence of cluster powdery mildew (Table 3). The SCALA and ROVRAL treatments had no effect on cane powdery mildew (Table 4).

CONCLUSIONS: SCALA appears to be an effective control for bunch rot although 1999 was not considered a bunch rot year due to dry weather throughout most of the season. It wasn't possible to determine if early or late application would be more effective from this trial. Both ROVRAL and SCALA controlled cluster powdery mildew in this trial which was unexpected. As expected they did not control leaf or cane powdery mildew.

Table 1. Number of clusters, yield, and bunch rot at harvest on grapes treated with SCALA.

Program	No. Clusters	Weight (kg)	% Bunch Rot
Control	131.4 b[1]	12.9 b	16.0 a
ROVRAL	158.2 ab	18.9 ab	00.0 b
SCALA EARLY	194.4 a	23.6 a	00.0 b
SCALA LATE	170.2 ab	14.1 b	00.0 b
ANOVA Pr>F	0.133	0.050	0.004

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 2. Percent leaf powdery mildew incidence and severity of grapes treated with SCALA evaluated on 26 August and 14 October.

Program	26 August		14 October	
	Incidence	Severity	Incidence	Severity
Control	31.5 a[1]	2.6 a	97.0 a	51.3 a
ROVRAL	20.6 a	1.8 a	92.5 a	34.7 ab
SCALA EARLY	14.2 a	1.3 a	92.5 a	29.0 b
SCALA LATE	15.0 a	1.2 a	97.4 a	41.0 b
ANOVA Pr>F	0.136	0.234	0.050	0.004

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 3. Percent cluster powdery mildew incidence and severity of grapes treated with SCALA evaluated on 26 August and 14 October.

Program	26 August		14 October	
	Incidence	Severity	Incidence	Severity
Control	90.0 a[1]	30.5 a	70.0 a	17.5 a
ROVRAL	20.0 c	01.5 b	12.0 b	01.2 b
SCALA EARLY	28.0 bc	05.4 b	16.0 b	02.0 b
SCALA LATE	62.0 ab	19.3 ab	26.0 b	07.7 b
ANOVA Pr>F	0.003	0.006	0.001	0.004

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 4. Percent cane powdery mildew and severity of grapes treated with SCALA and evaluated on 14 October.

Treatment	Incidence	Severity
Control	65.3 a[1]	11.6 a
ROVRAL	65.3 a	09.8 a
SCALA EARLY	53.3 a	12.6 a
SCALA LATE	58.7 a	09.4 a
ANOVA Pr>F	0.777	0.865

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

2000 PMR REPORT # 82 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Pinot noir
PEST: Bunch rot, *Botrytis cinerea* Pers.:Fr.

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TITLE: EFFICACY OF ELEVATE AGAINST BUNCH ROT OF GRAPE, 1999

MATERIALS: ELEVATE 50 WDG (fenhexamid), NOVA 40 W (myclobutanil), ROVRAL 50W (iprodione),

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 15 year old vines. Spacing was 1.4 x 3.6 m for a panel of 5 grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with five replicates. Each 5-vine replicate had vines 1 and 5 as guards for disease evaluation, thus treatments were separated by 2 buffer vines. The treatments were applied until run-off with a handgun operated at approximately 860 kPa at a rate of 1000L water/ha. Treatments were applied on 18 June (Prebloom), 6 July (Postbloom), 6 August (Berry touch), 27 August (Cluster closure), 21 September (Veraison), 5 October (Preharvest). See below for application times and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 26 August, by examining ten leaves on each of four shoots per three middle vines, and on 10 berry clusters per three middle vines. This was repeated on 14 October when infection of canes was also determined by visually examining five internodes on each of three canes per vine and estimating percent infection. At harvest on 21 October, yield, number of clusters and number of clusters with bunch rot were recorded. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. Counts of cluster, leaf, and cane powdery mildew and bunch rot were converted to the percent infected per replicate and arcsin-transformed. The transformed data for leaf, cane, and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range Test was used to separate means (P = 0.05).

ROVRAL Program consisted of ROVRAL 50 W (150 g/100 L or 1.5 kg/ha) on 18 June, 6 July, 27 August, and 21 September. Harvest on 21 October.

ELEVATE Program consisted of ELEVATE 50 WDG (110 g/100 L or 1.1 kg/ha) on 10 June, 18 June, 27 August, 21 September, and 5 October. Harvest on 21 October.

ELEVATE + NOVA Program consisted of ELEVATE 50 WDG + NOVA 40 W (110 g/100 L or 1.1 kg/ha + 20g/100 L or 0.2 kg/ha) on 10 June, 18 June, 27 August, 21 September, and 5 October. Harvest on 21 October.

ROVRAL + NOVA Program consisted of ROVRAL 50 W + NOVA 40 W (150 g/100 L or 1.5 kg/ha + 20 g/100 L or 0.2 kg/ha) on 18 June, 6 July, 22 July, 6 August, 27 August, 21 September, and 5 October.

RESULTS: ELEVATE + NOVA controlled bunch rot at harvest (Table 1). The ELEVATE treatments did not affect the number of bunches or yield of grapes. ELEVATE + NOVA was as effective as ROVRAL + NOVA in controlling foliage powdery mildew (Table 2). ELEVATE alone was ineffective in controlling foliage powdery mildew, similar to ROVRAL, although ROVRAL was slightly more effective reducing severity of foliage powdery mildew in October. ELEVATE and ELEVATE + NOVA reduced the incidence and severity of powdery mildew on grape bunches although the ROVRAL + NOVA combination was the most effective treatment (Table 3). Neither ELEVATE treatment or ROVRAL was effective in reducing cane powdery mildew (Table 4).

CONCLUSIONS: The combination of ELEVATE + NOVA appears to be as effective as the ROVRAL + NOVA standard for control of both bunch rot and powdery mildew. Unfortunately 1999 was not conducive to bunch rot so any interpretation on the effectiveness of ELEVATE against this disease was inconclusive. ELEVATE alone has moderate effectiveness against powdery mildew especially on fruit.

Table 1. Percent *Botrytis* cluster infection (18 July), bunch rot, number of clusters, and yield at harvest (21 October) of grapes treated with ELEVATE.

Program	No. Clusters	Weight (kg)	% Bunch Rot
Control	131.4 a[1]	12.9 a	16.0 a
ROVRAL	158.2 a	18.9 a	00.0 b
ELEVATE	190.8 a	21.5 a	04.0 ab
ELEVATE + NOVA	189.6 a	19.2 a	00.0 b
ROVRAL + NOVA	184.0 a	18.2 a	00.0 b
ANOVA Pr>F	0.485	0.523	0.018

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 2. Percent leaf powdery mildew incidence and severity of grapes treated with ELEVATE evaluated on 26 August and 14 October.

Program	26 August		14 October	
	Incidence	Severity	Incidence	Severity
Control	31.5 a[1]	2.6 a	97.0 a	51.3 a
ROVRAL	20.6 ab	1.8 ab	92.5 ab	34.7 b
ELEVATE	18.3 ab	1.6 ab	96.3 a	40.0 ab
ELEVATE + NOVA	12.9 bc	0.9 bc	81.1 c	30.1 b
ROVRAL + NOVA	09.2 c	0.3 c	82.5 bc	27.6 b
ANOVA Pr>F	0.020	0.035	0.004	0.020

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 3. Percent cluster powdery mildew incidence and severity of grapes treated with ELEVATE evaluated on 26 August and 14 October.

Treatment	26 August		14 October	
	Incidence	Severity	Incidence	Severity
Control	90.0 a[1]	30.5 a	70.0 a	17.5 a
ROVRAL	20.0 bc	06.1 c	12.0 bc	01.2 bc
ELEVATE	52.0 b	13.9 b	34.0 b	04.2 b
ELEVATE + NOVA	50.0 b	06.1 bc	20.0 bc	01.7 bc
ROVRAL + NOVA	16.0 c	01.1 c	04.0 c	00.3 c
ANOVA Pr>F	0.0006	0.0001	0.0003	0.0001

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

Table 4. Percent cane powdery mildew and severity of grapes treated with ELEVATE and evaluated on 14 October.

Treatment	Incidence	Severity
Control	65.3 a[1]	11.6 a
ROVRAL	65.3 a	09.8 a
ELEVATE	58.7 a	10.5 a
ELEVATE + NOVA	54.7 a	10.1 a
ROVRAL + NOVA	26.7 b	04.1 a
ANOVA Pr>F	0.016	0.261

[1] Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan's Multiple Range Test.

2000 PMR REPORT # 83 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Peach (*Prunus persica* (L.) Batsch), cv. Redhaven
PEST: Brown rot, *Monilinia fructicola* (Wint.) Honey

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TITLE: USE OF ELEVATE FOR CONTROL OF BROWN ROT OF PEACHES IN 1999

MATERIALS: ELEVATE 50 WDG (fenheximid), MAESTRO 75 WDG (captan), ROVRAL 50 WP (iprodione)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. in an orchard block consisting of 20 mature peach trees spaced 4.8 x 3.6 m. The amount of water averaged approximately 6 litres per tree for a volume of 3075 litres per hectare. The experimental design was a randomized block with treatments replicated four times on single tree replicates. The treatments were applied until run-off with a handgun sprayer operated at approximately 860 kPa on 15 April (pink bud), 25 April (full bloom), 7 May (petal fall), 25 June (5 weeks after petal fall), 29 July (15 days before harvest) and 13 August (harvest). After the full bloom spray, one shoot from each tree was collected, placed in the greenhouse, and misted with approx. 1.0×10^5 conidia/mL of *Monilinia fructicola* on April 26. Ten to twenty blossoms per shoot were examined for infection by *M. fructicola* with the aid of a dissecting microscope approx. 1 week after the blossoms were placed in the greenhouse. Number of blighted blossoms were counted on 3 June by visually examining each tree for withered blossoms. At harvest on 13 August number of fruit in the tree with brown rot were recorded. One hundred healthy fruit were harvested from each single tree replicate by picking 50 fruit into each of two containers placed on each side of the tree. Fruit were immediately inoculated with *M. fructicola* (1×10^5 condia/mL) by misting each container with 20 squirts (approx. 40 mL) of suspension. Fruit containers were placed in poly bags to maintain high relative humidity and left at 1 C for 7 days, however no rot developed so the fruit were put at 20 C for 5 more days at which time brown rot was recorded. These values were converted to percent infected and the arcsin transformed values were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range test was used for multiple comparison of means and the detransformed means were reported.

RESULTS: In the greenhouse on detached shoots infection by *M. fructicola* was significantly reduced by the MAESTRO treatment from 60 to 10%. In the orchard very little blossom blight occurred and could not be analysed. At harvest brown rotted fruit only occurred in a few trees and did not result in any significant differences between treatments. Fruit stored at 20 C for 5 days developed significant brown rot. The low rate of ELEVATE and MAESTRO were as effective as the ROVRAL standard in controlling brown rot. The high rate of ELEVATE was the most effective treatment reducing brown rot from 38 to 9.0%.

CONCLUSIONS: MAESTRO is the most effective material for control of blossom infection. The low rate of ELEVATE is as effective as ROVRAL for control of fruit brown rot. The high rate of ELEVATE is more effective than MAESTRO for the control of fruit brown rot.

Table 1. Percent brown rot in inoculated blossoms, at harvest and after storage at 20 C for 5 days.

Treatment and Rate/100 L (kg/ha)[1]	Blossoms infected in Greenhouse	Fruit infected at harvest in orchard	Fruit infected after storage for 5 days
CHECK	60.0 b[2]	0.8 a	38.0 a
ROVRAL 56.9 g (1.8 kg/ha)	40.0 b	0.0 a	14.5 bc
ELEVATE 35.8 g (1.1 kg/ha)	55.0 b	1.0 a	10.5 bc
ELEVATE 55.3 g (1.7 kg/ha)	100.0 a	0.2 a	09.0 c
MAESTRO 130.1 g (4.0 kg/ha)	10.0 c	0.0 a	14.8 b
ANOVA Pr>F	0.0006	0.60	0.0001

[1] Rate is based on 6 L of water per tree for 3075 litres per hectare.

[2] These values are means of four replications. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P 0.05).

2000 PMR REPORT # 84 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Pear, cv. Anjou
PEST: Powdery mildew, *Podosphaera leucotrica* (Ell. and Ev.) Salm.

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TITLE: EFFICACY OF NOVA AGAINST POWDERY MILDEW ON PEAR, 2000

MATERIALS: KUMULUS (sulphur), MINERALL CLAY (glacial marine clay), NOVA 40 WP (myclobutanil)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on Anjou pear trees approximately 30 years-old on seedling rootstocks spaced at 6.0 x 7.5 m. Average volume of water applied per tree was 6 litres for a total of 3075 litres per hectare. Treatment quantities for each 100 litres of water were based on these water volumes. Twenty trees were separated into 4 blocks of 5 random single tree replicates per block. The treatments were applied until run-off with a handgun operated at 800 kPa. Treatments were applied on 18 April (pink), 27 April (full bloom,), 9 May (petal fall), 19 May (first cover), 30 May (second cover), 31 August (14 days before harvest). Powdery mildew was evaluated by counting the number of fruit out of 25 per replicate that were russeted and the area of the fruit covered by russetting. The first evaluation was done on 12 July and the second and final evaluation was on 14 September, the same day the pears were harvested. These counts were converted to percent russeted fruit per tree (incidence),and mean area russeted per fuit (severity). Because the values were proportions they were arcsin-transformed and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range test at p=0.05 was used for multiple comparison of means.

RESULTS and DISCUSSION: NOVA, NOVA followed by MINERALL CLAY, and KUMULUS all reduced incidence of fruit russeting to low levels in July (Table 1). Following the July reading the incidence of fruit russeting increased and only the treatment with NOVA, or NOVA followed by MINERALL CLAY kept the incidence of fruit russeting to less than the untreated control. However the severity of russeting was lower for all treatments at the final recording in September. The amount of russet on the treated pears would not likely have lowered the grade because it was less than 1-cm in diameter. KUMULUS was not as effective as NOVA or NOVA followed by MINERALL CLAY in reducing the incidence of fruit russet at harvest. A large increase in the incidence of fruit russet occurred between July and harvest. Possibly additional cover sprays would have reduced the incidence of powdery mildew at harvest. Rust mites were not observed in the plot and frost did not occur over the duration of the trial.

CONCLUSIONS: Treatments containing NOVA, NOVA followed by MINERALL CLAY, and KUMULUS are very effective in reducing severity of fruit russet caused by powdery mildew.

Table 1. Percent incidence and severity of fruit russet as a result of pear powdery mildew.

Treatment (application date) grams/100 L of water (Kg/ha)	% Fruit Russet[1]			
	Incidence		Severity	
	14 JUL	14 SEP	14 JUL	14 SEP
NOVA (18, 27 APR, 9, 19, 30 MAY, 31 AUG) 11.3g (0.34)	14.2 b[2]	86.1 b	0.6 b	4.4 b
NOVA (18, 27 APR) 11.3 g (0.34) MINERALL CLAY (9, 19, 30 MAY, 31 AUG) 4.0 kg (120.0)	16.1 b	81.1 b	1.1 b	4.2 b
KUMULUS (18, 27 APR, 9, 19, 30 MAY, 31 AUG) 0.2 kg (6.0)	19.0 b	98.0 a	0.9 b	5.9 b
UNTREATED CONTROL	90.4 a	98.5 a	11.8 a	12.7 a

[1] The values for russet incidence and severity are the means of five replications. Russet severity is the average percent russet covering the fruit surface.

[2] These data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Duncan's Multiple Range Test.

2000 PMR REPORT # 85 **SECTION J: DISEASES OF FRUIT**
STUDY DATA BASE: 390 1252 9201

CROP: Raspberry cv. Willamette
PEST: Fruit rots, *Botrytis cinerea, Rhizopus sp., Cladosporium sp.*

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TITLE: EFFICACY OF FUNGICIDES FOR THE CONTROL OF FRUIT ROT IN RASPBERRIES IN 2000.

MATERIALS: MAESTRO 80 DF (captan), ELEVATE 50 WDG (fenhexamid), SWITCH 65.2 WG (cyprodinil +fludioxonil)

METHODS: The trial was conducted in 2000 in a rapsberry planting at Agassiz, B.C. Each treatment was applied to 4.25 m x 1 m plots replicated four times in a randomized complete block. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 1000L/ha of water at a pressure of 415 kPa. Each treatment was applied four times: May 17 (10 % bloom stage), May 30 (80 %bloom stage), June 15 (100% bloom stage and some set berries) and June 26 (fruit set). Harvest began on June 27 and continued until July 21. At each picking, marketable, rot and cull weights were recorded. Size index, based on the gram weight of 50 marketable berries, was also recorded at each picking. Two postharvest fruit rot trials were set up. In both, twenty randomly picked berries from the marketable yield were placed on styrofoam plates covered with damp paper towels. The plates were then covered with plastic wrap. In one trial the prepared plates were left at ambient temperature and rots counted approximately 3 days later. The other set was put in cold storage at 2 C for 6 days and then stored at ambient temperature for approximately 3 days before rots were counted. The main postharvest rots that developed were *Botrytis cinerea, Rhizopus sp.* and Cladosporium sp. Data were analysed with the general linear models procedure (SAS institute, Cary, NC) and means were separated using the Duncan's Multiple Range Test.

RESULTS: Data are presented in Tables 1, 2, 3 and 4. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Field rots were reduced by all treatments. Size index was not detrimentally affected by any treatment. In the ambient temperature postharvest trials, *Botrytis cinerea* was reduced by all treatments. In the cold/ambient temperature postharvest trial, all treatments again reduced *Botrytis cinerea.* There was no effect on *Rhizopus* or *Cladosporium* sp. in the ambient trials. There was also no effect on Rhizopus rot in the cold/ambient trials, however there was an effect with *Cladosporium* sp. *Cladosporium* sp. was reduced by ELEVATE + MAESTRO.

Table 1. Marketable weight, rot weight, size index and percentage field rot of raspberries.

Treatment	Rate (g ai/ha)	Marketable Weight (g/m^2)	Rot Weight (g/m^2)	Size Index (g/25 berries)	% Rot
CHECK	-	2623 ab[1]	25.5 a	126.5 b	1.0 a
SWITCH	625	3201 a	8.6 b	138.5 a	0.3 b
ELEVATE	550	2732 ab	7.7 b	133.1 ab	0.3 b
ELEVATE	850	2459 ab	9.4 b	128.9 ab	0.4 b
MAESTRO	2750	1978 b	5.7 b	127.9 ab	0.3 b
ELEVATE+ MAESTRO	550+ 2750	2966 a	10.5 b	136.8 ab	0.3 b

[1] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Percentage of berries infected by *Botrytis cineara* after being stored at ambient temperature following harvest.

Treatment	Rate (g ai /ha)	Jun 27[1] Jun 29	Jun 30 Jul 03	Jul 04 Jul 07	Jul 07 Jul 10	Jul 14 Jul 17	Jul 18 Jul 21	Jul 21 Jul 24
CHECK	-	53.3 a[2]	60.0 a	85.0 a	76.7 a	80.0 a	63.3 a	21.7 a
SWITCH	625	13.3 b	37.8 ab	15.6 b	22.2 b	53.3 bc	31.1 b	8.9 ab
ELEVATE	550	21.7 b	38.3 ab	26.7 b	38.3 b	50.0 bc	16.7 b	16.7 ab
ELEVATE	850	28.3 b	43.3 ab	26.7 b	23.3 b	40.0 c	21.7 b	5.0 b
MAESTRO	2750	15.0 b	50.0 a	23.3 b	50.0 ab	68.3 ab	23.3 b	3.3 b
ELEVATE+ MAESTRO	550 2750	11.1 b	13.3 b	24.4 b	28.9 b	37.8 c	20.0 b	6.7 b

[1] First date: set up, second date: rots counted.

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 3. Percentage of berries infected by *Botrytis cineara* after being stored in cold storage then at ambient temperature following harvest.

Treatment	Rate (g ai/ha)	Jun 30[1] Jul 05 Jul 08	Jul 04 Jul 10 Jul 13	Jul 07 Jul 13 Jul 16	Jul 11 Jul 17 Jul 20	Jul 14 Jul 20 Jul 23	Jul 18 Jul 24 Jul 26
CHECK	-	88.3 a[2]	95.0 a	80.0 a	98.3 a	100.0 a	63.3 a
SWITCH	625	46.7 bc	64.4 ab	33.3 b	55.6 b	75.6 b	20.0 b
ELEVATE	550	71.7 ab	86.7 ab	41.7 b	56.7 b	60.0 bc	23.3 b
ELEVATE	850	46.7 bc	56.7 b	36.7 b	60.0 b	73.3 b	15.0 b
MAESTRO	2750	78.3 a	85.0 ab	43.3 b	63.3 b	70.0 bc	25.0 b
ELEVATE+ MAESTRO	550+ 2750	40.0 c	77.8 ab	20.0 b	66.7 b	46.7 c	20.0 b

[1] First date: set up, second date: berries taken out of storage, third date: rots counted.

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 4. Percentage of berries infected by *Cladosporium sp.* after being stored in cold storage then at ambient temperature following harvest.

Treatment	Rate (g ai/ha)	Jun 30[1] Jul 05 Jul 08	Jul 04 Jul 10 Jul 13	Jul 07 Jul 13 Jul 16	Jul 14 Jul 20 Jul 23	Jul 18 Jul 24 Jul 26
CHECK	-	60.0 ab[2]	70.0 ab	50.0 a	70.0 a	85.0 a
SWITCH	625	51.1 ab	73.3 a	53.3 a	68.9 a	60.0 b
ELEVATE	550	73.3 a	70.0 ab	53.3 a	73.3 a	85.0 a
ELEVATE	850	61.7 ab	75.0 a	56.7 a	66.7 a	75.0 a
MAESTRO	2750	36.7 bc	36.7 b	30.0 ab	40.0 b	60.0 b
ELEVATE+ MAESTRO	550 2750	17.8 c	66.7 ab	22.2 b	57.8 ab	57.8 b

[1] First date: set up, second date: berries taken out of storage, third date: rots counted.

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

END OF SECTION J - FRUIT DISEASES
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SECTION K:	**VEGETABLES and SPECIAL CROPS - Diseases** **/les maladies des légumes et cultures spéciales**
REPORT /RAPPORT #:	**86 - 92**
PAGES:	**219 - 237**
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2000 PMR REPORT # 86 **SECTION K: VEGETABLES and SPECIAL CROPS - Diseases**
STUDY DATA BASE #: 402-1531-8605

CROP: American ginseng (*Panax quinquefolium* L.)
PEST: Damping-off and root rot, *Pythium* spp. and *Phytophthora cactorum* (Lebert & Cohn) J Schrot

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TITLE: EFFICACY OF RIDOMIL 1G AND RIDOMIL 2G FOR THE CONTROL OF GINSENG DAMPING-OFF AND ROOT ROT I. GREENHOUSE TRIAL, 1998

MATERIALS: RIDOMIL 2 G (2% metalaxyl), RIDOMIL 1 G (1% enantomorphic metalaxyl)

METHODS: The trial was conducted in the Pacific Agri-Food Research Centre (PARC), Summerland, B.C. research greenhouse. Replicates consisted of plastic flats (1.0 x 1.0 x 0.02 m) that covered 1 m^2 filled with autoclaved planting material (1:1:1 soil, sand, vermiculite). Each flat was planted with 22 two-month-old ginseng transplants. Ginseng plants were shaded with screening to remove 70% of the available light. RIDOMIL 1G, and 2G, treatments were applied to the appropriate flats, arranged in a completely random design, on 17 July at a rate of 31.25 kg/ha. The granular fungicide was thoroughly watered into the soil. The trial consisted of four experiments; inoculation with *Phytophthora cactorum, Pythium ultimum*, combination of both *P. cactorum* and *Pythium ultimum*, and RIDOMIL 1G and 2G not inoculated. Each experiment was replicated three times. Planting material was inoculated with *P. cactorum* 23 July according to the method of Li et al. (1997): *P. cactorum* obtained from Dr. Reeleder, AAFC, Delhi, ON was grown on corn meal agar for 1 wk at 18 C, and mycelium with agar from this culture was blended to a fine consistency in a tissue culture grinder with 5 mL of clarified V8 broth. The supernatant was diluted with distilled water (1:4) and was poured into culture bottles containing 100 mL V8 broth and mixed; 5 mL aliquots were pipetted into 60 x 15 mm Petri plates. These cultures were incubated for 2 days at 25 C and then at 18 C for 3-4 wk in darkness. Mycelial mats were removed and blended with 100 mL sterile water at 10 sec intervals for 2 min. *Pythium ultimum* was combined with the planting material and inoculated on 21 July. The isolate was *Pythium ultimum* 144 obtained from Dr. J. Holly, Alberta Agriculture, Food and Rural Development, Crop Diversification Centre South, Brooks AB and was originally isolated from tobacco seedlings. The *Pythium* inoculum was prepared in a similar manner according to the method of Lévesque (1990). Number of healthy and number of declining ginseng seedlings were recorded on 13 August, and again on 5 October. The data was arcsin transformed and subjected to analysis of variance according to the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range Test was used to separate means (P = 0.05).

RESULTS: There were no treatment differences on 13 August, but by 5 October clear differences between treatments occurred in two of the four experiments. RIDOMIL 1G and 2G prevented seedlings from dying when they were inoculated with *P. cactorum* alone or in combination with *Pythium* spp. (Table 1). RIDOMIL 1G or 2G had no significant effect on growth of seedlings.

CONCLUSIONS: RIDOMIL 1G has the same effectiveness as RIDOMIL 2G in preventing *P. cactorum* from infecting ginseng seedlings alone or in combination with *Pythium ultimum*. Furthermore, neither of these RIDOMIL formulations are phytotoxic.

REFERENCES CITED

Li, T.S.C., R.S. Utkhede, and D.A. Wardle. 1997. Chemical and biological control of leaf blight and root rot caused by *Phytopthora cactorum* in American ginseng. Can. J. Plant Pathol. 19:297-300.

Levesque, A. 1990. The nature and significance of fungal colonizers in the herbicical effect of glyphosate. Ph. D. Thesis, Simon Fraser University, Burnaby, BC.

Table 1. Percent ginseng plants surviving after treatment with RIDOMIL 1G and 2G.

Treatment and Rate (Kg/ha)	Inoculum			
	Py. ultimum	*P. cactorum*	Combined fungi[1]	None
Control	100.0 a[2]	55.3 a	58.3 a	97.0 a
RIDOMIL 1G 31.25	95.3 a	96.0 b	95.3 b	91.3 a
RIDOMIL 2G 31.25	93.0 a	100.0 b	92.0 b	97.3 a
ANOVA Pr > F	0.418	0.001	0.022	0.877

[1] Combined fungi treatment was inoculation with *P. catorum* followed by inoculation with *Pythium ultimum*.

[2] Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (*P* = 0.05).

2000 PMR REPORT # 87 **SECTION K: VEGETABLE and SPECIAL CROPS - Diseases**
ICAR: 206003

CROP: Iceberg Head Lettuce (*Lactuca sativa* L.) cv. Ithaca
PEST: Downy mildew, *Bremia lactucae* (Regal)

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TITLE: FIELD EVALUATION OF BREMCAST: A FORECASTING SYSTEM FOR DOWNY MILDEW OF LETTUCE, 2000.

MATERIALS: RIDOMIL GOLD MZ (metalaxyl- 3.9%, mancozeb 64%), RIDOMIL 240 EC (metalaxyl 240 g/l) and ALIETTE (fosetyl 80%).

METHODS: Lettuce was seeded on 7 April into 128 cell plug trays at the Muck Crop Research Station (MCRS). The trial was transplanted (3 plants/meter, 4 rows/bed spaced 42 cm apart) on 12 May into organic muck soil pH 6.4, organic matter 60%). Assessments for downy mildew began after transplanting (12 May). Several times per week, between 8 and 11 am, 15 plants per replication were assessed for downy mildew incidence until harvest. Each plot consisted of 4 treatments with 4 replications in a randomized complete block design. Fungicide treatments, were initiated following transplanting. The fungicides were applied using a pull type plot sprayer with Tee jet D-2 hollow cone nozzles at 100 psi. (boom). The Conventional treatments (sprayed as recommended in the Ontario Ministry of Agriculture, Food and Rural Affairs Vegetable Production Recommendations, Pub 363. 2000) were sprayed on a 7 to 10 day (protection period) schedule with ALIETTE or a 14 to 21 day (protection period) schedule with RIDOMIL GOLD MZ. A RIDOMIL 240 EC drench before transplanting treatment was included, where subsequent fungicide applications began 29 days after transplanting using the BremCast Forecasting System (explained below).

BremCast (BREMia foreCAST) is software developed by Kushalappa and coworkers (Kushalappa, 1999. PMRR. 218-219). BremCast forecasts/calculates daily infection values (INFV), sporulation values (SPOV), disease severity values (DSV)and cumulative disease severity values (CDSV) from planting until harvest of various host, pathogen/disease and environmental parameters influencing the development of downy mildew in the field. Also, the DSVs and CDSVs indicate predicted disease risk, and thus indicate appropriate timing for fungicide applications.

Leaf wetness was assessed visually at assessments and also recorded at 1 min intervals using an electronic grid leaf wetness sensor and placed in the leaf canopy. Temperature was recorded using a HMP35C temperature and relative humidity probe. All sensors were connected to a CR21X Campbell Scientific Data logger and data was stored at 15 min averages. Incoming solar radiation was recorded using a Li-Cor Pyranmeter, measuring KJ/m^2. No fungicides were applied to the control plots. Recommended control procedures for fungal and bacterial pathogens, weeds and insects were followed. The air temperatures were above the long term (10 year) average for May (13.6 °C), below average for June (17.5 °C), July (18.7 °C) and August (18.7 °C) and average for September (14.5 °C). Total rainfall was above the long term (10 year) average for May (160.3 mm), June (173.4 mm), and August (75.7 mm), below average for September (79.8 mm) and average for July (86.4). At harvest a sample of 25 heads from each repetition were graded for downy mildew incidence and disease severity. Disease severity was assessed using a scale from zero to five: zero = no lesions, one = 1 lesion, two = 2-5 lesions, three = 6-10 lesions, four = 11-15 lesions and five > 16 lesions. The total head number/scale was then multiplied by a factor (zero x 0, one x 1, two x 2 three x four, four x 8, and five x 16) and then all numbers were summed for disease severity. Head weight, of 25 heads, was also recorded. Data was analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V. 4.1. Means separation was obtained using Fisher's Protected LSD test at P= 0.05 level of significance.

RESULTS: As presented in Table 1, and 2.

CONCLUSIONS: All treatments significantly reduced downy mildew severity compared to the control (Table 1). The BremCast Forecasting treatment and the RIDOMIL 240 EC drench treatment, significantly reduced downy mildew incidence compared to the control. Both treatments also reduced the number of fungicide applications from 3 to 1 or 2. The RIDOMIL drench treatment, had significantly smaller heads than the other treatments. Due to the extremely wet spring, sections of the research plot were flooded on two separate occasions. This may have caused stunting which may explain the differences in harvest weights (Table 2). Possible phytotoxicity of the RIDOMIL drench has to be investigated further. The extremely wet conditions also delayed harvest. This resulted in higher disease incidence since the heads were unprotected and conditions were optimum for infection.

Table 1. Downy mildew incidence % (DMI) and severity (DMS) from 25 heads, 2000.

Treatment	DMI (%)	DMS
Control	99.0 b[1]	353.5 c[2]
Conventional - ALIETTE and RIDOMIL GOLD MZ	85.0 ab	215.5 b
BremCast Forecasting System (BFS) - ALIETTE and RIDOMIL GOLD MZ	55.6 a	69.5 a
RIDOMIL 240 EC drench + BFS	47.3 a	30.8 a

Table 2. Lettuce harvest weights (g) per head and number of spray applications, 2000.

Treatment	Weight (kg)	# Times Sprayed
Control	628 a[2]	0
Conventional - ALIETTE and RIDOMIL GOLD MZ	648 a	3
BremCast Forecasting System (BFS) - ALIETTE and RIDOMIL GOLD MZ	632 a	2
RIDOMIL 240 EC drench + BFS	468 b	1

[1] Both tables, NS - no significant treatment effects were observed.

[2] Both tables, numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD test.

2000 PMR REPORT # 88 **SECTION K: VEGETABLES and SPECIALTY CROPS - Diseases**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Cortland
PEST: Onion Smut (*Urocystis cepulae* Frost)

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TITLE: EVALUATION OF FUNGICIDE AND INSECTICIDE TREATMENT COMBINATIONS FOR THE CONTROL OF ONION SMUT: FIELD TRIAL IN THE HOLLAND MARSH, 2000.

MATERIALS: PRO GRO D (carbathiin 30% + thiram 50%), DITHANE DG (mancozeb 75%), LORSBAN G (chlorpyrifos 15%), GOVERNOR WP (cyromazine 75%), AZTEC G (phosetbupirin 2.0% + cyfluthrin 0.1%), REGENT WG (fipronil 80%).

METHODS: The trial was conducted in naturally infested muck soil (pH 6.4, OM 60%) at the University of Guelph Muck Crops Research Station located in the Holland Marsh, Ontario. Plots were arranged in a randomized complete block design with a total of 20 treatments and four replications. PRO GRO 30/50D, GOVERNOR 75WP and REGENT 80WG seed treatments were film-coated at rates of 20, 50 and 25 g ai/kg of seed (cv. Cortland) respectfully by Dr. Alan Taylor in Cornell NY. Granular formulations of DITHANE DG (6.6 kg ai/ha), LORSBAN 15G (4.8 kg ai/ha) and AZTEC 2/0.1G (0.5 kg ai/ha) were applied in-furrow with the seed. The trial was seeded at a rate of 40 seeds/m of row on 5 May, using a push V-belt seeder. Each treatment plot consisted of four 6m rows of onions spaced 40 cm apart. Six separate 2m sections were randomly selected for each of five onion smut (OS) assessments and final yield. To determine initial stand, emergence counts were taken on 17, 24, 26, 30 May and 8 June in each 2m section. At the 1st leaf (9 Jun), 4th -5th leaf (3 Jul), 5th -7th leaf (12 Jul) and bulbing (19 Aug) growth stages, and at final harvest (21 Sep) all the onions in the 2m sections of row were pulled and visually examined for symptoms of OS. Twice weekly from 20 Jun to 8 Aug, dying onions were pulled and their cause of death (OS, onion maggot or other) was recorded. At final harvest (21 Sep), weight and bulb size were taken from the remaining 2m section of onions. Data was analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1. Interaction between fungicides (none, PRO GRO, DITHANE DG, PRO GRO+DITHANE DG) and insecticides (none, LORSBAN, GOVERNOR, AZTEC, REGENT) was analyzed using a 4 x 5 factorial design. When data was not normal, statistics were performed on arcsin√x transformed data.

RESULTS: A significant interaction between fungicides and insecticides was found only at the fourth assessment (Table 1). Significant main effects at all assessments showed that treatment combinations with PRO GRO + DITHANE DG had the least OS, followed by those with DITHANE DG and then PRO GRO. Similarly, treatments with LORSBAN had the least OS, followed by those with AZTEC, GOVERNOR and then REGENT. Significant differences were found among treatments for incidence of

OS at all assessments (Table 2), but not for final yield (data not shown). LORSBAN and AZTEC significantly reduced incidence of smut in comparison to the untreated check in three (52.5-72% OS reduction) and two (both 35% reduction) of the five assessments, respectively. Onions treated with GOVERNOR had significantly more OS than those treated with LORSBAN in four out of the five assessments. Treatments with GOVERNOR and REGENT were not significantly different than the untreated check. PRO GRO + LORSBAN and AZTEC significantly reduced OS in comparison to PRO GRO alone in two of the five assessments respectively. PRO GRO + GOVERNOR and REGENT had similar or slightly higher OS than PRO GRO alone at all assessments. PRO GRO + LORSBAN had significantly less OS than PRO GRO + GOVERNOR in all assessments. The DITHANE DG + insecticide treatments followed the same trend as the PRO GRO + insecticide treatments, except that DITHANE DG + AZTEC had similar or higher OS than DITHANE DG alone. PRO GRO + DITHANE reduced OS the best out of all 20 treatments in all assessments except for the first; the addition of insecticide did not affect control of OS. No significant differences were found among the insecticides when they were used in combination with PRO GRO + DITHANE DG in three out of the five assessments. The air temperatures were above the long term (10 year) average for May, below average for June, July and August and average for September. Total rainfall was above the long term average for May (160.3 mm), June (173.4 mm), and August (75.7 mm), below average for September (79.8 mm) and average for July (86.4mm).

CONCLUSIONS: Efficacy of fungicide treatments for control of OS varied depending on the selection of in-furrow insecticide. Similarly, the effect that an insecticide has on OS varied according to the fungicide treatment that it is used with. The most common trend observed was that treatments with LORSBAN and AZTEC had less OS than treatments with fungicide only; GOVERNOR and REGENT had the same or slightly higher incidence of OS. The best control of OS was achieved with PRO GRO + DITHANE DG and when LORSBAN was used in the treatment combination.

Table. 1 Main effects and interactions of fungicides and insecticides for the control of onion smut.

	Incidence of Onion Smut (%)				
Fungicide	1st true leaf 9 Jun	4-5 true leaf 3 Jul	5-7 true leaf 13 Jul	bulbing 19 Aug	harvest 21Sep
untreated	72.1 a	43.8 a	43.9 a	38.7 a	32.2 a
PRO GRO	56.4 b	16.8 b	17.4 b	19.3 b	15.0 b
DITHANE DG	51.4 b	7.1 b	8.8 c	5.9 c	4.7 c
PRO GRO + DITHANE DG	40.1 c	3.3 c	4.0 d	4.2 c	1.3 c
p value F	0.0000	0.0000	0.0000	0.0000	0.0000
Insecticide					
untreated	53.3 ab	20.0 ab	23.6 a	17.2 a	11.9 ab
LORSBAN	44.2 b	11.6 b	9.2 c	8.2 b	6.4 b
GOVERNOR	61.3 a	18.3 a	21.1 ab	21.5 a	17.1 a
AZTEC	53.0 ab	17.3 a	16.2 b	16.7 a	18.1 a
REGENT	63.2 a	21.4 a	22.5 a	21.6 a	13.0 ab
I p value	0.0159	0.0126	0.0001	0.0005	0.0079
I*F p value	0.9621	0.3400	0.2908	0.0013	0.3457

Table 2. Effectiveness of fungicides (PRO GRO, DITHANE DG and DITHANE DG + PRO GRO) in combination with insecticides (LORSBAN, GOVERNOR, AZTEC and REGENT) for OS control.

Treatment	Rate	Incidence of Onion Smut (%)				
		1st true leaf 9 Jun	4-5 true leaf 3 Jul	5-7 true leaf 13 Jul	bulbing 19 Aug[1]	harvest 21Sep
untreated		68.2 a-d[3]	48.3 ab	58.6 a	56.1 a	36.2 a
L[2]	4.8 kg ai/ha	57.9 b-f	32.4 bc	21.5 cd	15.7 d-f	17.2 cd
G	50 g ai/kg[4]	82.5 a	38.8 ab	49.8 ab	35.2 bc	36.3 a
A	0.5 kg ai/ha	73.5 a-c	48.8 ab	38.4 b	36.4 bc	38.1 a
R	25 g ai/kg	78.1 ab	50.9 a	51.1 ab	50.0 ab	33.2 ab
PG	20 g ai/kg	52.2 c-g	20.9 c-e	17.7 c-e	26.6 cd	6.68 de
PG+L	20 g ai/kg + 4.8 kg ai/ha	40.2 f-g	7.9 fg	8.0 e-g	9.8 fg	5.2 de
PG+G	20 g ai/kg + 50 g ai/kg	64.6 a-e	18.8 c-e	23.0 c	22.1 c-e	20.9 bc
PG+A	20 g ai/kg + 0.5 kg ai/ha	57.7 b-f	14.8 d-f	16.3 c-f	12.5 e-g	25.1 a-c
PG+R	20 g ai/kg + 25 g ai/kg	67.1 a-d	21.4 cd	21.9 cd	25.7 c-e	16.9 cd
DG	6.6 kg ai/ha	51.1 c-g	10.7 e-g	15.5 c-g	2.7 hi	6.2 de
DG+L	6.6 kg ai/ha + 4.8 kg ai/ha	46.1 d-g	4.4 g-i	4.2 fg	5.2 g-i	2.9 e
DG+G	6.6 kg ai/ha +50 g ai/kg	49.5 d-g	7.3 fg	8.6 d-g	6.8 f-h	6.5 de
DG+A	6.6 kg ai/ha + 0.5 kg ai/ha	51.7 c-g	4.4 g-i	6.1 fg	8.7 fg	7.0 de
DG+R	6.6 kg ai/ha +25 g ai/ha	58.6 b-f	8.5 fg	9.3 d-g	6.3 f-h	0.77 e
PG+DG	20 g ai/kg + 6.6 kg ai/ha	41.7 e-g	0.3 i	2.5 g	0.53 i	0 e
PG+DG+L	20 g ai/kg + 6.6 kg ai/ha + 4.8 kg ai/ha	32.3 g	1.8 hi	2.9 g	1.9 i	0.44 e
PG+DG+G	20 g ai/kg + 6.6 kg ai/ha + 50 g ai/kg	48.6 d-g	8.3 f-h	2.9 g	4.5 g-i	4.4 de
PG+DG+A	20 g ai/kg + 6.6 kg ai/ha + 0.5 kg ai/ha	29.0 h	1.4 hi	4.0 fg	9.3 f-h	1.9 e
PG+DG+R	20 g ai/kg + 6.6 kg ai/ha + 25 g ai/kg	49.0 d-g	4.7 gh	7.6 e-g	4.6 g-i	1.2 e

[1] Statistics performed on $\arcsin\sqrt{x}$ transformed data.

[2] **L**: LORSBAN, **G**: GOVERNOR, **A**: AZTEC, **R**: REGENT, **PG**: PRO GRO, **DG**:DITHANE DG.

[3] Numbers in a column followed by the same letter are not significantly different at p=0.05, Fisher's Protected LSD test.

[4] Seed treatment : g ai/kg of seed for GOVERNOR, REGENT and PRO GRO.

2000 PMR REPORT # 89 SECTION K: VEGETABLES and SPECIALTY CROPS - Diseases
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Quantum, Gazzete
PEST: Onion Smut (*Urocystis cepulae* Frost)

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TITLE: EVALUATION OF *ALLIUM* PRODUCTS AS GERMINATION STIMULANTS FOR CONTROL OF ONION SMUT, GREENHOUSE TRIALS, IN 2000.

MATERIALS: DPDS (n-propyl disulphide 88%, related compounds 2%), GARLIC OIL (composition unknown,0.5 ± 0.1 ppm diallyl disulphide), GARLIC SKAPE JUICE (composition unknown, 0.26 ± 0.03 ppm diallyl disulphide), GARLIC POWDER (composition unknown, 0.9 ± 0.4 ppm diallyl disulphide), HOMEMADE ONION JUICE (composition unknown).

METHODS: Two trials were conducted under semi-controlled conditions in the greenhouse to determine if the application of various *Allium* products to soil would stimulate onion smut (OS) spore germination and reduce incidence of onion smut. Naturally infested muck soil (pH 6.4, OM 60%, 190% moisture) was collected from the field at the Muck Crops Research Station, sieved through 2mm mesh and thoroughly mixed by hand with 2.5 mL *Allium* product or 15 mL DPDS in solution per 10 L of soil. The rates applied were equivalent to L/ha product in 500 L/ha water in the top 20 cm of soil in a field. The treatments were 2% DPDS (United AgriProducts) at 60 L/ha, 1 and 2% GARLIC OIL (Gibbson Foods) at 5 and 10 L/ha, 2% GARLIC SKAPE JUICE (Perth Garlic Growers) at 10 L/ha, 0.2g/mL GARLIC POWDER (Empire Foods) at 280 kg/ha in 1500 L/ha water, and 2% HOMEMADE ONION JUICE at 10 L/ha. Tap water was used as an untreated check. Treated soil was stored at room temperature (23.1 ± 2 C, max: 26.9 C, min: 17.8 C) in closed black polyethylene bags. After 15 weeks, the single application trial was seeded. After 13 weeks, the soil was treated again and stored for another 17 weeks (21.0 ± 1.4 C, max: 23.6 C, min: 17.8 C) before seeding the double application trial. All trials were seeded in 200 plug trays and arranged in a randomized complete block design with two cultivars, seven treatments and four replications. To delay emergence and to increase the infection window, trials were started in a cool dark room for the first two weeks (single: 16.7 ± 2.2 C, max: 21.9 C, min: 12.0 C; double: 14.0 ± 1.0 C, max: 15.5 C, min: 12.0 C) before they were moved onto the greenhouse benches (single: 8.5 ± 1 C, max: 20 C, min: 7 C; double: 14.5 ± 2.0 C, max: 37.4 C, min: 7.0 C). One hundred randomly selected plants were pulled and visually examined for incidence of OS when the flag leaves were fully developed and again after the majority of flag leaves had died. Data was analyzed using the General Analysis of Variance function of the Linear Models section of Statistix, V.4.1.

RESULTS: Significant differences among cultivars were found at all assessments in both trials except in the first assessment of the double application trial (Table 1). In general, Gazette had higher incidence of OS than Quantum. Significant differences among treatments were found at all assessments in both trials except in the Quantum cultivar of the second assessment in the double application trial. In all cases, incidence of OS was less in the second assessment after the flag leaf had died (15.4 - 57.1%) in comparison to the initial infection (35.7 -81.9%). Best control of OS was achieved consistently with the synthetic germination stimulant, DPDS in all assessments (9 - 59% reduction compared to the untreated). GARLIC SKAPE JUICE and GARLIC POWDER significantly reduced OS compared to the untreated in the single application trial by 17.1 and 21.6% respectively at the first assessment in the Gazette cultivar and by 18.8 and 18.0% (NS) at the second assessment in the Quantum cultivar. The two rates of GARLIC OIL and HOMEMADE ONION JUICE were never significantly different than the untreated except at the second assessment of the single application trial where HOMEMADE ONION JUICE reduced incidence of OS by 16.0% in the Quantum cultivar. Although not significant, the *Allium* product treatments had higher incidence of OS compared to the untreated in 18 out of the 42 cases. Applying a second treatment to the soil did not enhance the efficacy of any of the *Allium* product treatments. The double soil application of DPDS provided an additional 60 and 50.3% reduction in OS Quantum and Gazette cultivars respectively, at the second assessment, compared to the single soil applications.

CONCLUSIONS: At the rates tested, none of the *Allium* products applied as soil treatments were adequate at reducing incidence of OS. Since DPDS applied at 60 L/ha in 500 L/ha of water provided moderate control of OS, this suggests that the *Allium* products needed to be applied at higher rates. The *Allium* products have not been analyzed for DPDS content, but knowing this would be useful for further investigation of their potential for controlling OS.

Table 1. Effectiveness of single and double applications of Allium products as germination stimulants to naturally infested muck soil for OS control, greenhouse trials, in 2000.

Single Soil Application (treated: 16-Jul-99; planted: 31-Oct-99)

		Incidence of Onion Smut (%)			
		mature flag leaf		flag leaf dead	
Treatment	Rate (L/ha in 500L/ha water)	Quantum	Gazette	Quantum	Gazette
untreated		63.9 bc[1]	81.9 a	46.7 a	51.4 ab
DPDS	60	53.3 d	57.7 d	35.7 a	37.8 c
GARLIC OIL	5	65.5 bc	74.8 ab	47.5 a	53.3 ab
GARLIC OIL	10	75.5 a	80.4 a	46.8 a	57.1 a
GARLIC SKAPE JUICE	10	61.4 c-d	64.2 cd	37.9 b	42.5 bc
GARLIC POWDER	280 kg/ha in 1500L/ha water	65.5 bc	67.9 bc	38.3 b	50.7 ab
HOMEMADE ONION JUICE	10	67.4 ab	74.0 ab	39.2 b	55.6 a

Double Soil Application (treated: 23-Jul, 22-Oct-99; planted: 26-Feb-00)

		Quantum & Gazette[2]	Quantum	Gazette
untreated		38.3 cd	16.8 NS[3]	33.0 a
DPDS	60	28.2 c	15.8	15.4 c
GARLIC OIL	5	41.7 bc	19.6	23.5 a-c
GARLIC OIL	10	41.6 bc	19.3	26.0 a-c
GARLIC SKAPE JUICE	10	49.0 ab	23.9	29.9 ab
GARLIC POWDER	280 kg/ha in 1500L/ha water	57.1 a	24.4	31.0 ab
HOMEMADE ONION JUICE	10	44.1 bc	23.7	23.6 a-c

[1] Columns followed by the same letter are not significantly different at p=0.05, Fisher's Protected LSD test.

[2] No significant differences were found between cultivars, results are pooled.

[3] No significant difference was found among treatments at p=0.05, Fisher's Protected LSD test.

2000 PMR REPORT # 90 **SECTION K: VEGETABLE and SPECIAL CROPS - Diseases**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Fortress
PEST: White Rot, *Sclerotium cepivorum* (Berk)

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TITLE: FIELD EVALUATION OF BOTRAN 75 W DRENCH FOR THE CONTROL OF ONION WHITE ROT, 2000

MATERIALS: BOTRAN 75 W (dicloran 75%), FOLICUR (tebuconazole 38.7%)

METHODS: Two field trials were conducted in organic soil naturally infested with white rot in commercial onion fields in the Bradford marsh in 2000. At both sites, plots were designed within areas the growers had experienced a problem with white rot the previous time onions were grown in that field. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 4 rows spaced (site 1) and 5 rows spaced (site 2), 3 m in length. Both sites were seeded with 33 seeds/meter. BOTRAN was applied as a plant-based drench. BOTRAN was applied at three different timings. The treatments were a) 4 and 7 true leaf stage, b) 4, 7 and 10 true leaf stage and c) 7 true leaf stage. All treatments were applied at 3.67 kg/ha in 2000 L/ha of water at each application. FOLICUR (1.0 kg/ha in 2000 L/ha of water) was applied at the 7 true leaf stage and used as the standard treatment. All treatments were applied using a Solo back pack sprayer with a Tee-jet 8010 nozzle. An untreated check was also included. Incidence and severity of white rot was rated at harvest on 28 August (site 1) and 30 August (site 2). A scale of 1 to 10 was used to assess severity: 1 = mycelium covering 1-2 cm of onion bulb, 5 = 4-5 cm of bulb covered, 10 = covers basal half of bulb with mycelium. The air temperatures were above the long term (10 year) average for May (13.6 ºC), below average for June (17.5 ºC), July (18.7 ºC) and August (18.7 ºC) and average for September (14.5 ºC). Total rainfall was above the long term (10 year) average for May (160.3 mm), June (173.4 mm), and August (75.7 mm), below average for September (79.8 mm) and average for July (86.4). Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1. Means separation was obtained using Fisher's Protected LSD test at P= 0.05 level of significance.

RESULTS: As outlined in Tables 1 & 2.

CONCLUSIONS: Significant differences were observed among the treatments in site 1. All BOTRAN treatments significantly reduced the incidence of onion white rot at site 1. compared to the check. The full rate of BOTRAN (11.0 kg/ha) had significantly lower white rot than the FOLICUR. The full rate also had the lowest severity rating at site 1. At site 2 the BOTRAN applied at one-third the full rate had the lowest incidence of onion white rot although, overall, there was no significant difference in the incidence or severity of the disease among treatments. Although sufficient rain fell throughout the season for white rot development, due it the timing of the last application (8-10 true leaves) the BOTRAN may not have all penetrated into the soil. Rainfall after application may have benefitted the treatments.

Table 1. Field evaluation of BOTRAN 75 W for white rot control as a band application, 2000 (Site 1).

Treatment	Number of Applications	Incidence of White Rot %	Severity Rating[1]
Check	0	48.3 a[2]	4.4 NS[3]
FOLICUR @ 1.0 kg/ha	1	43.0 bc	4.8
BOTRAN @ 3.67 kg/ha	1	36.8 ab	3.6
BOTRAN @ 3.67 kg/ha	2	38.3 ab	3.2
BOTRAN @ 3.67 kg/ha	3	34.0 a	3.2

[1] 1 = mycelium covering 1-2 cm of onion bulb, 5 = 4-5 cm of bulb covered, 10 = covers basal half of bulb with mycelium.

[2] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

[3] NS = No significant differences (P = 0.05, Fisher's Protected LSD Test) were found among the treatments.

Table 2. Field evaluation of BOTRAN 75 W for white rot control as a band application, 2000 (Site 2).

Treatment	Number of Applications	Incidence of White Rot %	Severity Rating [1]
Check	0	10.4 NS[2]	4.6 NS
FOLICUR @ 1.0 kg/ha	1	8.6	4.2
BOTRAN @ 3.67 kg/ha	1	8.0	4.2
BOTRAN @ 3.67 kg/ha	2	9.2	4.8
BOTRAN @ 3.67 kg/ha	3	8.8	6.0

[1] 1 = mycelium covering 1-2 cm of onion bulb, 5 = 4-5 cm of bulb covered, 10 = covers basal half of bulb with mycelium.

[2] NS = No significant differences (P = 0.05, Fisher's Protected LSD Test) were found among the treatments.

2000 PMR REPORT # 91 **SECTION K: VEGETABLE and SPECIAL CROPS - Diseases**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Gazette
PEST: Onion Smut, *Urocystis cepulae* (Frost)

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TITLE: EVALUATION OF FILM COATING AND FURROW FUNGICIDE TREATMENTS FOR CONTROL OF ONION SMUT IN COMBINATION WITH INSECTICIDE SEED TREATMENTS, 2000

MATERIALS: ALLEGIANCE (metalayl 28.4%), CHARTER (triticonazole 2.4%), DITHANE DG (mancozeb 75%), REGENT (fipronil 80%), LORSBAN 15G (chlorpyrifos 15%), GOVERNOR (cyromazine 75%), PRO GRO (carbathiin 30%, thiram 50%), RAXIL (tebuconazole 28.4%), THIRAM (thiram 75%), methyl cellulose

METHODS: Possible interactions between fungicides and insecticides were investigated in the field to identify alterative controls for onion smut. Onions (cv. Gazette) were seeded (46 seeds/m) in organic soil (pH 6.4, organic matter 60%) naturally infested with onion smut at the Muck Crops Research Station on 3 May, 2000. Treatments were: REGENT at 30 g ai/ kg of seed, REGENT + PRO GRO at 20 g ai/kg of seed, REGENT + THIRAM at 12.5 g ai/100 g of seed + ALLEGIANCE at 310 mg ai/ 100 g of seed, REGENT + THIRAM at 12.5 g ai/ kg of seed + ALLEGIANCE at 310 mg ai/ kg of seed + CHARTER at 1 g ai/ kg of seed, REGENT + THIRAM at 12.5 g ai/ kg of seed + ALLEGIANCE at 310 mg ai/ kg of seed + RAXIL at 1 g ai/ kg of seed. All above treatments were repeated using GOVERNOR at 50 g ai/ kg of seed in the place of REGENT . Two standard treatments were also included. GOVERNOR and PRO GRO treated pelleted seed + DITHANE DG at 8.8 kg/ha and LORSBAN 15G at 32 kg/ha product + PRO GRO treated pelleted seed + DITHANE DG at 8.8 kg/ha. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 2 rows (42 cm apart), 5 m in length. All treatments were seeded using a push cone seeder. All DITHANE DG and LORSBAN 15G treatments were applied using a push V-belt seeder along with the seed. Three random 2 m sections were marked off, and germination counts were recorded (15, 17, 23, and 29 May) to determine initial stands. At one (9 June) and three (29 June) true leaves, one of the 2 m sections were harvested and evaluated by looking at the bulb and leaves for evidence of smut. The remaining 2 m section was evaluated on 25 September. A yield sample of 2.33 m was taken on 25 September. The air temperatures were above the long term (10 year) average for May (13.6 °C), below average for June (17.5 °C), July (18.7 °C) and August (18.7 °C) and average for September (14.5 °C).. Total rainfall was above the long term (10 year) average for May (160.3 mm), June (173.4 mm), and August (75.7 mm), below average for September (79.8 mm) and average for July (86.4). Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1. Means separation was obtained using Fisher's Protected LSD test at P= 0.05 level of significance.

RESULTS: As outlined in Table 1.

CONCLUSIONS: Significant differences were found among treatments. Both CHARTER and RAXIL with both insecticides had significantly lower onion smut than the REGENT and GOVERNOR checks on the first assessment. The standard treatments of GOVERNOR + PRO GRO + DITHANE DG and LORSBAN + PRO GRO + DITHANE DG had the lowest incidence of onion smut on all three assessment dates. The REGENT + PRO GRO also had low incidence of onion smut on the second and third assessments. Significant differences were found among treatments in yield. REGENT + THIRAM + ALLEGIENCE + RAXIL had the highest yield of all the treatments.

Table 1. Evaluation of film coating and furrow fungicides for the control of onion smut, 2000.

Treatments	Rate Product g ai/kg seed	Incidence of Smut %			Yield T/ha
		9 June	29 June	25 Sept.	
REGENT check	30	51.0 c[1]	32.3 c	9.1 abc	32.9 ef
REGENT + PRO GRO	30 + 20	27.2 ab	7.8 a	5.5 a	65.1 a-d
REGENT + THIRAM + ALLEGIANCE	30 + 12.5 +0.31	36.2 bc	14.4 ab	5.2 a	65.5 a-d
REGENT + THIRAM + ALLEGIANCE + CHARTER	30 +12.5 +0.31 + 1.0	23.2 ab	12.3 a	2.4 a	81.3 ab
REGENT + THIRAM + ALLEGIANCE + RAXIL	30 +12.5 +0.31 + 1.0	17.6 a	15.4 ab	5.9 a	86.2 a
GOVERNOR check	50	51.1 c	28.9 bc	19.7 bc	35.2 ef
GOVERNOR + PRO GRO	50 + 20	21.8 ab	8.8 a	12.7 abc	24.0 f
GOVERNOR+THIRAM + ALLEGIANCE	50 + 12.5 +0.31	48.3 c	7.1 a	22.2 c	58.5 b-e
GOVERNOR +THIRAM +ALLEGIANCE +CHARTER	50 + 12.5 +0.31 + 1.0	19.7 ab	12.5 a	8.6 a	50.1 de
GOVERNOR +THIRAM + ALLEGIANCE + RAXIL	50 +12.5 +0.31 + 1.0	17.9 a	7.0 a	5.9 a	63.6 a-d
GOVERNOR + PRO GRO pellet + DITHANE DG	8.8 kg/ha	10.0 a	1.3 a	0.0 a	54.8 cde
LORSBAN + PRO GRO pellet + DITHANE DG	32 kg/ha 8.8 kg/ha	11.8 a	8.5 a	1.8 a	79.5 abc

[1] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

2000 PMR REPORT # 92 **SECTION K: VEGETABLE and SPECIAL CROPS - Diseases**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Gazette
PEST: Onion Smut, *Urocystis cepulae* (Frost)
Damping-Off, *Pythium spp.*

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TITLE: EVALUATION OF FILM COATING FOR CONTROL OF ONION SMUT AND DAMPING-OFF IN GREENHOUSE TRIALS, 2000

MATERIALS: ALLEGIANCE (metalayl 28.4%), CHARTER (triticonazole 2.4%), PRO GRO (carbathiin 30%, thiram 50%), RAXIL (tebuconazole 28.3%), THIRAM (thiram 75%)

METHODS: A trial was conducted under controlled conditions in the greenhouse using naturally infected muck soil to evaluate several fungicides in combination for the control of onion smut and damping off. Onions cv. Gazette was seeded into 200 cell plug trays with organic soil (pH 6.4, organic matter 60%) collected in the fall of 1999 from the Muck Crops Research Station farm. The trial was planted on 7 April. Treatments were: CHARTER at 100 mg ai/ 100 g of seed, RAXIL at 100 mg ai/ 100 g of seed, ALLEGIANCE at 31 mg ai/100 g of seed + THIRAM at 1.25 g ai/ 100 g of seed, a combination of CHARTER, ALLEGIANCE and THIRAM and a combination of RAXIL, ALLEGIANCE and THIRAM. A standard application of PRO GRO at 2 g ai/ 100 g of seed was used. An untreated check was also included. A randomized complete block arrangement with 4 blocks per treatment was used. Trays were placed on a stacking cart in a temperature controlled dark room at 13°C to provide uniform germination and avoid temperature fluctuations. Once most of the onions emerged the trays were moved to the greenhouse and placed on ebb-flow benches. Temperatures were set at 15°C. Gemination counts were taken to determine stand and record plants which damped off. One hundred plants were assessed for the incidence of smut at five (first true leaf) and seven weeks (three true leaf) after planting. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1. Means separation was obtained using Fisher's Protected LSD test at P= 0.05 level of significance.

RESULTS: As outlined in Tables 1 and 2.

CONCLUSIONS: Significant differences were observed among the treatments on both assessment dates. The treatment of ALLEGIANCE + THIRAM + CHARTER had significantly higher emergence than the check and CHARTER alone. ALLEGIANCE + THIRAM + RAXIL had significantly lower damping-off in the 2nd assessment than the check. ALLEGIANCE + THIRAM + RAXIL also had significantly lower percent of onion smut on both assessments than the check. PRO GRO however, had the lowest percent onion smut of all the treatments. ALLEGIANCE + THIRAM+ CHARTER significantly reduced onion smut compared to the check on both assessments dates. This treatment also significantly reduced damping-off in the second assessment. In the second assessment, the treatments ALLEGIANCE + THIRAM and ALLEGIANCE + THIRAM + CHARTER had similar numbers for percent damping-off (1.6 and 1.9 respectively), and were significantly better than CHARTER alone. It appears that ALLEGIANCE and THIRAM are providing some control of damping-off. More work needs to be done on these fungicides, to find new combinations of controlling onion smut and damping-off.

Table 1. Evaluation of film coating on the incidence of onion smut and damping-off on onions grown in the greenhouse - 1st assessment, 2000.

Treatments	Rate g ai/ 100g of Seed	1st assessment % emerged	1st assessment % Damping-off	1st assessment % Smut
Check		89.0 b[1]	8.4 a	67.2 d
PRO GRO	2.0	95.3 a	1.9 a	4.4 a
CHARTER	1.0	82.8 c	7.5 a	59.8 d
RAXIL	1.0	92.0 ab	2.2 a	18.0 ab
ALLEGIANCE + THIRAM	3.1 + 1.25	95.0 a	6.0 a	36.6 c
ALLEGIANCE + THIRAM + CHARTER	3.1 + 1.25 + 1.0	95.8 a	2.7 a	31.8 bc
ALLEGIANCE + THIRAM + RAXIL	3.1 + 1.25 + 1.0	93.5 ab	1.4 a	16.3 a

[1] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

Table 2. Evaluation of film coating on the incidence of onion smut and damping-off on onions grown in the greenhouse - 2nd assessment, 2000.

Treatments	Rate g ai/ 100g of Seed	2nd assessment % emerged	2nd assessment % Damping off	2nd assessment % Smut
Check		90.3 b[1]	16.3 c	51.8 c
PRO GRO	2.0	94.0 ab	2.4 ab	8.5 a
CHARTER	1.0	81.8 c	10.12 bc	51.2 c
RAXIL	1.0	94.3 ab	3.3 ab	31.9 b
ALLEGIANCE + THIRAM	3.1 + 1.25	96.5 a	1.6 a	38.3 b
ALLEGIANCE + THIRAM + CHARTER	3.1 + 1.25 + 1.0	97.0 a	1.9 a	36.9 b
ALLEGIANCE + THIRAM + RAXIL	3.1 + 1.25 + 1.0	95.8 ab	1.6 a	33.7 b

[1] Numbers in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD Test.

2000 PMR REPORT # 93 **SECTION K: VEGETABLE and SPECIAL CROPS - Diseases**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Gazette
PEST: Onion Smut, *Urocystis cepulae* (Frost)

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TITLE: EVALUATION OF FILM COATING FOR CONTROL OF ONION SMUT GREENHOUSE TRIALS, 2000

MATERIALS: CHARTER (triticonazole 2.4%), PRO GRO (carbathiin 30%, thiram 50%), RAXIL (tebuconazole 28.3%)

METHODS: Two trials were conducted under controlled conditions in the greenhouse using naturally infected muck soil to evaluate CHARTER and RAXIL for the control of onion smut. Onions (cv. Gazette) were seeded into 200 cell plug trays with organic soil (pH 6.4, organic matter 60%) collected in the fall of 1999 from the Muck Crops Research Station farm. Trials were planted on 8 February (Trial 1) and 14 March (Trial 2). Treatments were: CHARTER at 5, 10, 25, 50, 100 mg ai/ 100 g of seed and RAXIL at 5, 10, 25, 50, 100 mg ai/ 100 g of seed. A standard application of PRO GRO at 2 g ai/ 100 g of seed was used. A 0.75% film coat of Opadry AG was used as an untreated check. A randomized complete block arrangement with 4 blocks per treatment was used. Trays were placed on a stacking cart in a temperature controlled dark room at 13°C to provide uniform germination and avoid temperature fluctuations. Once most of the onions emerged the trays were moved to the greenhouse and placed on ebb-flow benches. Temperatures were set at 15°C. Gemination counts were taken to determine stand and record plants which damped off. One hundred plants were assessed for the incidence of smut at five (first true leaf) and ten weeks (three true leaf) after planting. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1. Means separation was obtained using Fisher's Protected LSD test at P= 0.05 level of significance. A regression analysis was obtained using the Linear Regression test in Linear Models.

RESULTS: As outlined in Tables 1 and 2.

CONCLUSIONS: RAXIL at 100 g ai/100 g seed was not significantly different in the percent emergence or the percentage of onion smut on any assessments in both trials, compared to the standard PRO GRO treatment. However, the PRO GRO treatment was numerically higher than the RAXIL. RAXIL at 50 g ai/100g seed also was not significantly different from the standard on the first assessment in both trials. A moist paper test before seeding showed no differences in emergence. Damping off was the main reason for the reduced emergence in some CHARTER and RAXIL treatments. The PRO GRO treatment contains THIRAM which controls damping off. CHARTER did not seem to control smut at any of the rates used. More studies are needed to look at higher rates of RAXIL since they seem to give some control. The combination of fungicides to control damping off also need to be evaluated.

Table 1. Evaluation of film coating on the incidence of onion smut on onions grown in the greenhouse Trial 1,2000.

Treatments	Rate g ai/ 100g of Seed	1st assessment % emerged	1st assessment Incidence of Smut %	2nd assessment % emerged	2nd assessment Incidence of Smut %
Film Coating	0.75%	80.0 bc[1]	49.4 d	54.3 de	49.0 cde
PRO GRO	2.0	91.0 a	2.5 a	89.5 a	24.6 a
CHARTER	5.0	83.0 bc	48.5 d	68.5 bc	56.5 e
CHARTER	10.0	81.8 bc	36.3 c	56.8 c-e	55.3 e
CHARTER	25.0	81.8 bc	46.8 d	63.8 bcd	55.3 e
CHARTER	50.0	80.5 bc	35.1 c	70.5 b	45.1 cd
CHARTER	100.0	79.5 c	22.8 b	60.3 b-e	43.1 bcd
RAXIL	5.0	78.5 c	37.6 c	60.0 b-e	52.0 de
RAXIL	10.0	81.0 bc	23.5 b	66.8 bc	47.6 cde
RAXIL	25.0	78.0 c	16.9 b	58.8 b-e	41.6 bc
RAXIL	50.0	81.5 bc	4.6 a	51.0 e	44.9 cd
RAXIL	100.0	86.8 ab	3.2 a	66.3 bc	33.3 ab

[1] Numbers in a column followed by the same letter are not significantly different at $P = 0.05$, Fisher's Protected LSD Test.

Regression of rate vs. disease incidence:
1st Assessment Charter - Significant differences ($P = 0.0001$), $R^2 = 0.5202$
% Incidence of smut = 47.490 - 0.2424 * Rate
1st Assessment Raxil - Significant differences ($P = 0.000$), $R^2 = 0.5962$
% Incidence of smut = 35.180 - 0.3992 * Rate
2nd Assessment Charter - Significant differences ($P = 0.0117$), $R^2 = 0.2557$
% Incidence of smut = 54.444 - 0.1183 * Rate
2nd Assessment Raxil - Significant differences ($P = 0.0034$), $R^2 = 0.3286$
% Incidence of smut = 49.780 - 0.1589 * Rate

Table 2. Evaluation of film coating on the incidence of onion smut on onions grown in the greenhouse Trial 2,2000.

Treatments	Rate g ai/ 100g of Seed	1st assessment % emerged	1st assessment Incidence of Smut %	2nd assessment % emerged	2nd assessment Incidence of Smut %
Film Coating	0.75%	80.3 d[1]	62.5 e	70.3 ef	35.6 d
PRO GRO	2.0	96.0 a	1.6 a	95.0 a	17.7 a
CHARTER	5.0	77.8 de	52.3 de	73.3 de	34.0 cd
CHARTER	10.0	73.5 e	42.7 cd	68.8 ef	21.9 ab
CHARTER	25.0	79.0 de	54.9 de	69.8 ef	32.6 cd
CHARTER	50.0	81.5 cd	50.5 de	70.5 ef	31.2 cd
CHARTER	100.0	80.8 d	37.7 c	71.0 ef	35.4 d
RAXIL	5.0	83.0 cd	58.7 e	66.3 f	31.6 cd
RAXIL	10.0	82.0 cd	32.6 c	79.3 cd	32.0 cd
RAXIL	25.0	87.0 bc	16.8 b	79.3 cd	26.9 bcd
RAXIL	50.0	90.3 ab	7.6 ab	84.3 bc	26.6 bc
RAXIL	100.0	93.0 a	6.4 ab	89.8 ab	19.3 ab

[1] Numbers in a column followed by the same letter are not significantly different at $P = 0.05$, Fisher's Protected LSD Test.

1st Assessment Charter - Significant differences ($P = 0.0228$), $R^2 = 0.2141$
% Incidence of smut = 55.201 - 0.1609 * Rate
1st Assessment Raxil - Significant differences ($P = 0.00$), $R^2 = 0.5775$
% Incidence of smut = 46.949 - 0.5169 * Rate
2nd Assessment Charter - Not significant
2nd Assessment Raxil - Significant differences ($P = 0.0050$), $R^2 = 0.3067$
% Incidence of smut = 33.219 - 0.1436 * Rate

END OF SECTION K
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SECTION L: **FIELD LEGUMES**
/LÉGUMINEUSES DE GRANDE CULTURE

REPORT /RAPPORT #: **94 - 113**

PAGES: **238 - 285**

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2000 PMR REPORT # 94 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cvs. US 1140 (Great Northern) and UI 906 (Black)
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF DRY BEAN IN 2000

MATERIALS: APRON FL (metalaxyl, 317 g/L SN), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), LS 176, CAPTAN 400 (Captan, 457g/L SU)

METHODS: Seed of dry bean cvs. US 1140 and UI 906 was treated with VITAFLO 280 at 2.6 mL/kg, CAPTAN 400 at 2.1 mL/kg seed, VITAFLO 280 + APRON FL at 2.6 and 0.05 mL/kg seed, respectively, and a combination of LS 176 and APRON FL at 3.1 and 0.16 mL/kg seed, respectively in a Hege II small batch seed treater. Experimental plots were established on 19 May at Brooks, Alberta in brown chernozemic clay loam soil. Plots were seeded in a split-plot randomized complete block design with four replications. Soybean cultivars served as main plots and fungicide seed treatment, along with *Rhizoctonia*-inoculated and non-inoculated controls, served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted for each subplot three weeks after seeding. Plots were harvested using a small plot combine on 15 September. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence and seed yield were significantly greater (*P* 0.05) for all seed treatments tested compared to the inoculated control (Table 1). Plant stand was significantly greater (*P* 0.05) for the VITAFLO 280 and LS 176 seed treatments than for the CAPTAN seed treatment. Treatments that included APRON had emergence levels similar to those of the noninoculated control. Yield was similar among all seed treatments in the trial. US 1140 had a significantly (*P* 0.05) lower emergence than UI 906, but US 1140 produced a significantly (*P* 0.05) greater yield (Table 2).

CONCLUSIONS: All seed treatments in the trial improved plant stand and seed yield over the nontreated inoculated control. While all seed treatments in the trial resulted in a similar yield, the two VITAFLO 280 treatments and the LS176 treatment produced better plant stands than the CAPTAN seed treatment.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of dry bean cvs. US1120 and UI 906 at Brooks, Alberta in 2000.

Treatment	Rate (mL/kg seed)	Plant stand /6m	Seed yield (T/ha)
Control + *R*[1]	-	28.5 d[2]	4.85 c
VITAFLO 280 + *R*	2.6	47.8 b	7.44 ab
VITAFLO 280+APRON+*R*	2.6 + 0.05	50.6 ab	7.84 ab
LS 176+APRON +*R*	3.1 + 0.16	51.1 ab	7.35 ab
CAPTAN 400 +*R*	2.1	35.5 c	6.73 b
Control	-	55.9 a	7.98 a

[1] Denotes inoculation with *Rhizoctonia solani*.

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

Table 2. Comparison of plant stand and seed yield of dry bean cvs. US 1140 and UI 906 at Brooks, Alberta in 2000.

Cultivar	Plant stand /6m	Seed yield (T/ha)
US 1140	36.3 b[1]	7.76 a
UI 906	53.4 a	6.30 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (P 0.05).

2000 PMR REPORT # 95 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61006537

CROP: Edible beans, cs. Stingray White bean, AC Compass White bean, SVM Taylor Cranberry bean, Montcalm Dark Red Kidney bean
PEST: Seedling diseases

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TITLE: CONTROL OF SEEDLING DISEASE IN DRY EDIBLE BEANS WITH SEED TREATMENTS

MATERIALS: VITAFLO 280 (carbathiin + thiram, 150 + 130 g ai/L); APRON XL (metalaxyl-m, 369 g ai/L); APRON MAXX (fludioxonil + metalaxyl-m, 96.5 + 144 g ai/L); MAXIM 480 FS(fludioxonil, 480 g ai/L); Maxim/Apron XL/Dividend 96 FS (fludioxonil + metalaxyl-m + difenoconazole, 10.9 + 32.6 + 52.2 g ai/L); DCT (diazinon + captan + thiophanate methyl, 18% + 6% + 14% w/w); CROWN (carbathiin + thiabendazole, 92 + 58 g ai/L); BAYTAN 30 G (triadimenol 30% w/w); L1022.

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 2.3 ml per kg.) of material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. In furrow granular insecticides were applied using a Noble® applicator. Beans were planted 17 May, 2000 at a seeding rate of 15 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 2 rows 6 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Plot emergence and vigor, using a scale of 1-10 (10 = best plant development and 1 = 10% of most advanced plant development), were assessed on 5 June, 2000. Ten plants from the control plots were selected randomly for determination of the incidence of disease. Root rot ratings were assessed in 1 m/row using a scale of 1-8 (1=no lesions, 2=slight, 3=<1.0 cm lesion not encircling, 4=>1.0 cm lesion not encircling, 5=<1.0 cm lesion but encircling, 6=>1.0 cm lesion encircling. 7= severely girdled, 8=dead). Plots were hand harvested 13 & 14 September, 2000.

RESULTS: As reported in Tables 1-10.

CONCLUSIONS: Emergence and vigor were quite variable within plots, which may have masked some of the benefits of seed treatments. Most seed treatments improved emergence and early seedling vigor compared with the controls. Some treatments significantly improved yield and decreased root rot of white beans cv Compass. None appeared phytotoxic. None of the seed treatments were consistently superior across varieties..

Table 1. Crop emergence of Stingray white beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Emergence # Plants			
		5-6-00	16-6-00	23-6-00	13-7-00
CONTROL		83	74	79	79
APRON XL + MAXIM	0.10 ml + 0.05 ml	110	108	109	109
APRON MAXX	0.26 ml	122	129	129	124
Maxim/ApronXL/ Dividend 96 FS	2.2 ml	125	124	130	129
DCT +Water	5.2 g + 10 ml	132	134	140	134
VITAFLO +APRON	2.3 ml + 1.6 ml	124	127	126	124
L1022-A1	1.6 ml	114	116	114	124
CROWN +APRON	1.5 + 0.8 ml	99	97	99	99
APRON + Baytan granular	0.8 ml + 4.5 g/row	117	115	120	118
LSD (P=.05)		NS	NS	NS	NS
CV		27.9	28.7	30.6	28.2

Table 2. Crop vigor ratings of Stingray white beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Vigor (1-10)			
		5-6-00	16-6-00	23-6-00	13-7-00
CONTROL		3.5	3.3	3.8	5
APRON XL +MAXIM	0.10 ml + 0.05 ml	5.5	4.8	4.0	6.3
APRON MAXX	0.26 ml	4.8	4.5	4.0	6.8
Maxim/ApronXL/ Dividend 96 FS	2.2 ml	5	4.8	5.3	6.5
DCT + Water	5.2 g + 10 ml	6.5	7.0	7.3	7.3
VITAFLO + APRON	2.3 ml + 1.6 ml	6	6.3	5.5	8.5
L1022-A1	1.6 ml	4	5.0	6.5	7
CROWN + APRON	1.5 + 0.8 ml	5.3	3.8	4.5	6
APRON + Baytan granular	0.8 ml + 4.5 g/row	4.5	5.8	4.3	6.8
LSD (P=.05)		NS	NS	NS	NS
CV		59.4	57.1	56.6	45.7

Table 3. Emergence counts of Compass white beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/ kg seed	Emergence # Plants			
		5-6-00	16-6-00	23-6-00	13-7-00
CONTROL			106	98 c[1]	101 b
APRON XL+ MAXIM	0.10 ml + 0.05 ml	125	128	122 ab	122 a
APRON MAXX	0.26 ml	120	120	117 ab	113 ab
Maxim/Apron XL/ Dividend 96 FS	2.2 ml	114	116	114 b	118 a
DCT + Water	5.2 g + 10 ml	117	126	127 a	119 a
VITAFLO + APRON	2.3 ml + 1.6 ml	112	114	115 ab	114 a
L1022-A1	1.6 ml	123	121	120 ab	111 ab
CROWN + APRON	1.5 + 0.8 ml	96	120	120 ab	118 a
APRON + Baytan granular	0.8 ml + 4.5 g/row	111	114	113 b	121 a
LSD (P=.05)		NS	NS	12.7	12.4
CV		14.6	7.4	7.5	7.4

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 4. Crop vigor ratings of Compass white beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Vigor (1-10)			
		5–6-00	16-6-00	23-6-00	12-7-00
CONTROL		6.3	5.3	4.3	8.0 abc[1]
APRON XL + MAXIM	0.10 ml + 0.05 ml	6.5	5.5	5	9.3 ab
APRON MAXX	0.26 ml	5.3	3.3	4.8	6.8 c
Maxim/Apron XL/ Dividend 96 FS	2.2 ml	2.8	3.8	5	6.3 c
DCT + Water	5.2 g + 10 ml	5.3	4.5	5.3	6.8 c
VITAFLO + APRON	2.3 ml + 1.6 ml	6.3	4.8	5.5	9.5 a
L1022-A1	1.6 ml	2.8	6.8	5	8.3 abc
CROWN + APRON	1.5 + 0.8 ml	5.8	5	4.3	7.0 c
APRON + Baytan granular	0.8 ml + 4.5 g/row	4.3	6.3	6	7.3 bc
LSD (P=.05)		NS	NS	NS	2.21
CV		53.7	57.8	61.9	19.8

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 5. Crop emergence of Cranberry beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Emergence # Plants			
		5-6-00	16-6-00	23-6-00	13-7-00
CONTROL		97	101	101	104
APRON XL + MAXIM	0.10 ml + 0.05 ml	114	118	123	123
APRON MAXX	0.26 ml	111	114	117	122
Maxim/Apron XL/Dividend	2.2 ml	106	119	121	123
DCT + Water	5.2 g + 10 ml	127	136	135	138
VITAFLO + APRON	2.3 ml +1.6 ml	114	124	127	125
L1022-A1	1.6 ml	120	123	126	130
CROWN + APRON	1.5 + 0.8 ml	111	116	115	121
APRON +Baytan granular	0.8 ml + 4.5 g/row	98	104	106	110
LSD (P=.05)		NS	NS	NS	NS
CV		17.4	13.9	13.9	14.8

Table 6. Crop vigor of Cranberry beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Vigor (1-10)			
		5-6-00	16-6-00	23-6-00	12-7-00
CONTROL		7.5	3.3	3.8	6.8
APRON XL + MAXIM	0.10 ml + 0.05 ml	5.8	6.3	5.3	8.3
APRON MAXX	0.26 ml	3	4.3	2.5	7
Maxim/Apron XL/Dividend	2.2 ml	3.8	5.3	5	7.5
DCT + Water	5.2 g + 10 ml	7	6.5	7.3	8
VITAFLO + APRON	2.3 ml + 1.6 ml	6.3	6.8	4.5	8.3
L1022-A1	1.6 ml	6.8	5	7.8	9
CROWN + APRON	1.5 + 0.8 ml	5.3	4.8	4.5	7.5
APRON + Baytan granular	0.8 ml + 4.5 g/row	4	3	4.5	7
LSD (P=.05)		NS	NS	NS	NS
CV		48.4	55.0	50.8	23.3

Table 7. Crop emergence of Kidney beans with seed treatments for seedling disease at Ridgetown, Ontario, 2000.

Treatment	Rate g or ml/kg seed	Emergence # Plants			
		5-6-00	16-6-00	30-6-00	13-7-00
CONTROL		67	69	66 bc [1]	67 bc
APRON XL +MAXIM	0.10 ml + 0.05 ml	65	75	65 bc	64 bc
APRON MAXX	0.26 ml	79	87	79 abc	82 abc
Maxim/Apron XL/Dividend	2.2 ml	79	89	87 a	93 a
DCT + Water	5.2 g + 10 ml	77	93	95 a	94 a
VITAFLO + APRON	2.3 ml + 1.6 ml	58	73	62 c	61 c
L1022-A1	1.6 ml	76	90	80 abc	85 abc
CROWN + APRON	1.5 + 0.8 ml	81	96	82 ab	86 ab
APRON + Baytan granular	0.8 ml + 4.5 g/row	87	96	92 a	94 a
LSD (P=.05)		NS	NS	20.4	24.0
CV		21.6	17.5	17.8	20.4

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 8: Crop vigor of Kidney beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Vigor (1-10)			
		5-6-00	16-6-00	30-6-00	12-7-00
CONTROL		5.3	5	4.5	7.5 abc[1]
APRON XL + MAXIM	0.10 ml + 0.05 ml	4	3.5	3.3	6.0 bc
APRON MAXX	0.26 ml	6.3	3.8	6	8.3 a
Maxim/Apron XL/Dividend	2.2 ml	6	4.3	4.8	8.0 ab
DCT + Water	5.2 g + 10 ml	7.3	6.8	6.5	9.5 a
VITAFLO 280 + APRON	2.3 ml + 1.6 ml	3.3	3	3.3	5.8 c
L1022-A1	1.6 ml	6.3	5	3.8	8.0 ab
CROWN + APRON	1.5 + 0.8 ml	6.8	6.8	6.3	8.8 a
APRON + Baytan granular	0.8 ml + 4.5 g/row	9	7	6.8	8.8 a
LSD (P=.05)		NS	NS	NS	2.03
CV		41.2	52.6	54.2	17.8

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 9: Yield and root rot of edible beans with seed treatments for seedling disease at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/ kg seed	Sting Yield kg/ha	Sting Rot 1-10	Comp Yield kg/ha	Comp Rot 1-10	Cran Yield kg/ha	Cran Rot 1-10	Kid Yield kg/ha	Kid Rot 1-10
CONTROL		1571	6.63	1819 ab[1]	6.63 b	971	4.25	751	6.50
APRON XL + MAXIM	0.10 ml 0.05 ml	1574	7.25	1778 ab	6.63 b	1299	4.50	663	7.63
APRON MAXX	0.26 ml	1558	7.25	1555 bc	8.00 a	1082	4.25	896	6.38
Maxim/Apron XL/Dividend	2.2 ml	1405	7.00	1384 c	7.38 ab	1110	4.38	993	7.38
DCT +Water	5.2 g 10 ml	1593	8.13	1363 c	7.25 ab	1108	4.00	1121	7.88
VITAFLO +APRON	2.3 ml 1.6 ml	1950	6.13	2104 a	7.88 ab	1458	5.63	679	8.00
L1022-A1	1.6 ml	1764	6.88	1845 ab	6.63 b	1378	5.00	1049	7.25
CROWN +APRON	1.5 0.8 ml	1548	7.25	1709 bc	8.00 a	1210	5.00	782	6.5
APRON +Baytan granular	0.8 ml 4.5 g /row	1885	6.50	1634 bc	8.38 a	1147	4.13	937	7.25
LSD (P=.05)		NS	NS	380.6	1.3	NS	NS	NS	NS
CV		47.4	14.7	15.5	11.9	21.2	29.8	28.9	114.6

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 10: Average incidence of disease organisms in 10 random plants in check plots at Ridgetown, Ontario. 2000.

	% Fusarium sp	% Pythium	% Phytophthora	% Rhizoctonia solani
Stingray	97.5	10	20	5
Compass	92.5	6	12.5	5
Cranberry	92.5	15	10	2.
Kidney	100	5	7.5	2.

2000 PMR REPORT # 96 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61006537

CROP: Edible beans, cs. Stingray White bean, AC Compass White bean, SVM Taylor Cranberry bean, Montcalm Dark Red Kidney bean
PEST: Seedling root rot, *Rhizoctonia solani, Fusarium sp.*

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TITLE: CONTROL OF SEEDLING ROOT ROT IN DRY EDIBLE BEANS WITH SEED TREATMENTS

MATERIALS: VITAFLO 280 (carbathiin + thiram, 150 + 130 g ai/L); APRON XL (metalaxyl-m, 369 g ai/L); APRON MAXX (fludioxonil + metalaxyl-m, 96.5 + 144 g ai/L); MAXIM 480 FS(fludioxonil, 480 g ai/L); MAXIM/APRON XL/DIVIDEND 96 FS (fludioxonil + metalaxyl-m + difenoconazole, 10.9 + 32.6 + 52.2 g ai/L; DCT (diazinon + captan + thiophanate methyl, 18% + 6% + 14% w/w); CROWN (carbathiin + thiabendazole, 92 + 58 g ai/L); BAYTAN 30 G (triadimenol 30% w/w); L1022-A1.

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 2.3 ml per kg.) of material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. In furrow granular insecticides were applied using a Noble® applicator. Beans were planted on 30 May, 2000 at a seeding rate of 20 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were single row 2 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Plants were inoculated with *Rhizoctonia solani* (see below) on 4 July, 2000 and the irrigated for 2 weeks with over-head misting. Root rot ratings were assessed on 10 plants/plot using a scale of 0-6 (0: no symptoms, 1:<= 25% taproot discolouration which is superficial, 2: >25% but <= 50% discolouration superficial, 3:>50% but <= 75% discolouration superficial, 4: > 75% but <= 100% discolouration superficial, 5: 100% discolouration but <=50% discolouration is deep, 6: 100% discolouration but > 50% discolouration is deep) on 28 July, 2000 and plot averages were calculated.

INOCULUM. *Rhizoctonia solani* inoculum was produced by weighing out 1 kg of hulless oats into each of several large pickle jars, covering oats with 2% V-8 juice and allowing mixture to sit for 1-2 hours. Excess liquid was then drained off, jar openings covered with tin foil under the lids, and jars autoclaved at 15 psi and 121° C for 30 min. Autoclaving was repeated 3 days later. A strain of *Rhizoctonia solani* (86-8b) was obtained from AAFC- Harrow Research Centre and cultured onto Potato Dextrose Agar (PDA). The PDA plates of *R. solani* were cut up into small square plugs and 6-8 plugs were placed in each jar of sterile oats. The jars were incubated at room temperature for 2 weeks. After 2 days of incubation there were golf ball sized chunks of inoculum present. Every third day the jars were shaken to distribute the inoculum evenly. After 2 weeks of incubation, 300 g inoculum was blended with 5 L of distilled water and sodium alginate was added as a thickener to make a 6 % GOOP suspension of inoculum. Ten ml syringes, with a large hole made in the end, were used to deliver 2 ml of the inoculum to each plant. Plants were inoculated with 1 ml of inoculum on each side of the stem at the soil line and misting was turned on. Irrigation was stopped after 10 days.

RESULTS: See Table 1.

CONCLUSIONS: There was evidence of some *Rhizoctonia solani*, but most of the root rot was in fact *Fusarium* species. None of the seed treatments reduced root rot scores.

Table 1: Root rot damage assessment in edible beans with artificial inoculation and misting at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Stingray 0-6 28-7-00	Compass 0-6 28-7-00	Cranberry 0-6 28-7-00	Kidney 0-6 28-7-00
CHECK		4.3	4.5	4.02	4
APRON XL + MAXIM	0.10 ml + 0.05 ml	4.22	4.55	3.78	3.63
APRON MAXX	0.26 ml	4.22	4.53	4.17	3.53
MAXIM/APRON XL/ DIVIDEND	2.2 ml	4.2	4.43	4.2	2.9
DCT + Water	5.2 g + 10 ml	4.3	4.48	3.85	3.7
VITAFLO 280 + APRON	2.3 ml + 1.6 ml	4.3	4.35	4	3.47
L1022-A1	1.6 ml	4.5	4.3	3.83	3.68
CROWN + APRON	1.5 ml + 0.8 ml	4.47	4.47	3.68	3.13
APRON +Baytan granular	0.8 ml + 4.5 g/row	4.4	4.55	3.55	3.67
LSD (P=.05)		NS	NS	NS	NS
CV		5.9	5.8	10.6	21.8

2000 PMR REPORT # 97 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field bean (*Phaseolus vulgaris* L.)
PEST: Anthracnose, *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.

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TITLE: *IN VITRO* EVALUATION OF FUNGICIDES FOR THE INHIBITION OF *COLLETOTRICHUM LINDEMUTHIANUM*

MATERIALS: TILT 250 EC (propiconazole, 250 g/L EC), STRATEGO 250 EC (propiconazole + CGA-279202, 125 + 125 g/L EC), FLINT 125 EC (CGA-279202, 125 g/L EC), fludioxonil 50 WP (50 % WP), QUADRIS 250 SC (azoxystrobin, 250 g/L SU), ACTIGARD 50 WG (CGA-245704, 50% GR) and BRAVO 500 F (chlorothalonil, 500 g/L SU).

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing *Colletotrichum lindemuthianum* on potato-dextrose agar (PDA) plates amended with TILT, STRATEGO, FLINT, fludioxonil, QUADRIS, ACTIGARD and BRAVO, respectively. The final concentration of fungicides in the plates was adjusted to 0.001, 0.01, 0.05, 0.1, 0.25 and 0.5 µg/mL. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *Colletotrichum*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 C. A completely randomized design was used. Colony diameters were measured every 24 hr until the non-fungicide control plates were fully overgrown. Each treatment was tested on 10 plates and the bioassay was repeated once. Data were transformed to percent inhibition of mycelial growth by comparing with non-amended controls, and subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System (SAS Institute, Cary, NC).

RESULTS: TILT, STRATEGO and QUADRIS were highly suppressive to *Colletotrichum* growth on the PDA plates, even at low concentrations (Figure 1,Table 1). Amongst these chemicals, TILT inhibited 51 and 83% of *Colletotrichum* growth at 0.001 and 0.01 µg/mL, respectively. All three inhibited 100% of the growth where the concentration exceeded 0.1 µg/mL. ACTIGARD had the least inhibitory effect among the seven fungicides tested with 12% inhibition at the highest concentration. BRAVO achieved a high inhibitory effect when its concentration reached 0.5 µg/mL. However, the effects of FLINT and fludioxonil were always lower than 80% inhibition.

CONCLUSIONS: TILT, STRATEGO and QUADRIS were most effective fungicides for controlling *Colletotrichum* according to our *in vitro* bioassays. ACTIGARD had almost no effect on this fungus.

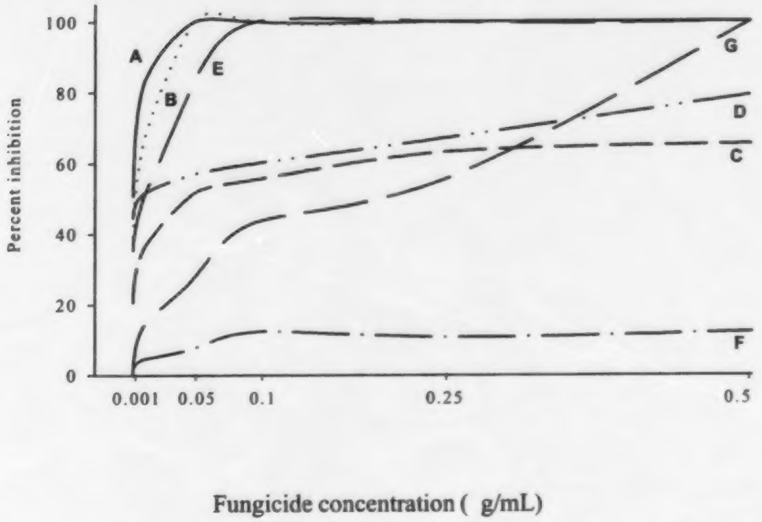

Figure 1. Dose-response of *Colletotrichum lindemuthianum* to seven fungicides in potato-dextrose agar. (A) TILT 250 EC, (B) STRATEGO 250 EC, (C) FLINT 125 EC, (D) Fludioxonil 50 WP, (E) QUADRIS 250 SC, (F) ACTIGARD 50 WG, and (G) BRAVO 500 F.

Table 1. Effects of seven fungicides on *Colletotrichum lindemuthianum* in *in vitro* bioassays in 2000.

Treatment	Inhibition of mycelial growth (%)[1]
TILT 250 EC	89.0 a
STRATEGO 250 EC	83.8 b
FLINT 125 EC	48.7 e
Fludioxonil 50 WP	59.9 d
QUADRIS 250 SC	78.2 c
ACTIGARD 50 WG	8.2 g
BRAVO 500 F	40.0 f

[1] Values are means of ten replications in each of six concentration levels of each fungicide. Means within a column followed by a common letter are not significantly different according to least significant difference at *P* 0.05.

2000 PMR REPORT # 98 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cvs. Myles and Sanford
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF CHICKPEA IN 2000

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), LS 176, APRON FL (metalaxyl, 317 g/L SN)

METHODS: Seed of chickpea cvs. Myles and Sanford was treated with VITAFLO 280 at 3.3 mL/kg seed, CROWN at 3.0 and 6.0 mL/kg seed and a combination of LS 176 and APRON FL at 3.1 and 0.16 mL/kg seed, respectively, in a Hege II small batch seed treater. Experimental plots were established on 18 May at Brooks, Alberta in brown chernozemic clay loam soil. Plots were seeded in a split-plot randomized complete block design with four replications. Chickpea cultivars served as main plots and fungicide seed treatment, along with *Rhizoctonia*-inoculated and non-inoculated controls, served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted for each subplot three weeks after seeding. At maturity (26 September), plants from the middle 5 m of each plot were hand-harvested. Seeds were threshed and weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence and seed yield were significantly (P 0.05) higher than the inoculated control where VITAFLO+APRON was applied and where CROWN was applied at the higher rate (Table 1). Plant stand and seed yield were also significantly (P 0.05) higher for these two fungicides than for LS 176, CROWN applied at the lower rate, and for APRON applied alone . Stand and yield were significantly (P 0.05) higher for Myles than for Sanford (Table 2).

CONCLUSIONS: VITAFLO+APRON and CROWN applied at the higher rate improved plant stand and seed yield over the inoculated control and over LS 176, CROWN applied at the lower rate, and APRON applied alone.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of chickpea cvs. Myles and Sanford at Brooks, Alberta in 2000.

Treatment	Rate (mL/kg seed)	Plant stand /6m	Seed yield (T/ha)
VITAFLO + APRON +*R*[1]	3.3 + 0.16	7.5 b[2]	0.64 b
CROWN +*R*	3	1.5 c	0.17 c
CROWN +*R*	6	5.6 b	0.64 b
LS 176+APRON +*R*	3.1 + 0.16	1.6 c	0.27 c
APRON +*R*	0.16	0.5 c	0.03 c
Control +*R*	–	0.1 c	0.02 c
Control	–	23.2 a	1.20 a

[1] Denotes inoculation with *Rhizoctonia solani*.

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

Table 2. Comparison of seedling establishment and seed yield of chickpea cvs. Sanford and Myles at Brooks, Alberta in 2000.

Cultivar	Plant stand /6m	Seed yield (T/ha)
Sanford	3.0 b[1]	0.29 b
Myles	8.4 a	0.56 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (P 0.05).

2000 PMR REPORT # 99 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. B-90
PEST: Root rot, *Rhizoctonia solani* Kuhn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA ROOT ROT OF CHICKPEA IN ALBERTA IN 2000

MATERIALS: MAXIM 480 (fludioxonil, 480g/L FS), APRON XL (metalaxyl-M, 369 g ai/L LS), APRON MAXX 240.5 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), DIVIDEND (difenoconazole, 32.8% FS), CRUISER (thiamethoxam, 350 g/L FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of chickpea cv. B-90 was treated in a Hege small batch seed treater with APRON MAXX at 3.75 g ai/100 kg seed, a combination of MAXIM and APRON XL at 2.5 and 3.75 g ai/100 kg seed, a combination of MAXIM, APRON and DIVIDEND (MAD) at 2.5, 7.5 and 12 g ai/100 kg seed, respectively, alone and combined with CRUISER at 50 g ai/100 kg seed. Seed was also treated with VITAFLO 280 at 88 g ai/100 kg seed. An experimental plot was established on 18 May, 2000 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 4 cm deep at a rate of 75 seeds per row. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row (3 x 10^2 CFU/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted 4 weeks after seeding. At maturity (27 September), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Both MAD formulations and VITAFLO 280 had significantly (*P* 0.05) greater seedling emergence and seed yield than APRON XL + MAXIM, APRON MAXX and the inoculated control (Table 1). APRON XL + MAXIM and APRON MAXX had emergence and yield values similar to those of the inoculated control. Emergence and yield were significantly (*P* 0.05) higher in the noninoculated control than in any of the inoculated treatments.

CONCLUSIONS: Both MAD formulations and VITAFLO 280 improved seedling emergence and seed yield over the inoculated control, while APRON XL + MAXIM and APRON MAXX did not.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of chickpea cv. B-90 at Brooks, Alberta in 2000.

Treatment	Rate	No. seedlings	Yield
	(g ai/100 kg seed)	/6m	(T/ha)
APRON XL+ MAXIM +*R*[1]	7.5 + 2.5	2.0 c[2]	0.57 c
APRON MAXX +*R*	3.75	1.4 c	0.55 c
MAD[3] +*R*	7.5+2.5+12	7.3 b	1.71 b
MAD + CRUISER +*R*	7.5+2.5+12+25	8.5 b	1.63 b
VITAFLO 280 +*R*	88	8.4 b	1.29 b
Control +*R*	--	0.1 c	0.01 c
Control	--	36.6 a	3.39 a

[1] Denotes inoculation with *Rhizoctonia*.

[2] Means within a column followed by the same letter are not significantly different for each experimental variable using Duncan's New Multiple Range Test (P 0.05).

[3] MAXIM+APRON XL+DIVIDEND

2000 PMR REPORT # 100 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. B-90
PEST: Root Rot, *Pythium ultimum* Trow, *P. irregulare* Buisman

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF PYTHIUM ROOT ROT OF CHICKPEA IN ALBERTA IN 2000

MATERIALS: MAXIM 480 (fludioxonil, 480g/L FS), APRON XL (metalaxyl-M, 369 g ai/L LS), APRON MAXX 240.5 (metalaxyl-M, 13.6% + fludioxonil, 9.11% MEC), DIVIDEND (difenoconazole, 32.8% FS), CRUISER (thiamethoxam, 350 g/L FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of chickpea cv. B-90 was treated in a Hege small batch seed treater with APRON MAXX at 3.75 g ai/100 kg seed, a combination of MAXIM and APRON XL at 2.5 and 3.75 g ai/100 kg seed, a combination of MAXIM, APRON and DIVIDEND (MAD) at 2.5, 7.5 and 12 g ai/100 kg seed, respectively, alone and combined with CRUISER at 50 g ai/100 kg seed. Seed was also treated with VITAFLO 280 at 88 g ai/100 kg seed. An experimental plot was established on 18 May, 2000 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 4 cm deep at a rate of 75 seeds per row. *Pythium ultimum* and *P. irregulare* were grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row (3×10^2 CFU/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted 4 weeks after seeding. At maturity (27 September), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence in both inoculated and noninoculated controls was significantly (*P* 0.05) lower than in any of the fungicidal seed treatments (Table 1). Seed yield was higher in all seed treatments tested compared to the inoculated control. Among the treatments tested, VITAFLO 280 resulted in the poorest emergence, but there were no differences with respect to yield.

CONCLUSIONS: All of the fungicides applied in the trial resulted in greater seedling emergence and seed yield compared to the inoculated control. APRON and MAD formulations resulted in a greater improvement in seedling emergence than VITAFLO 280.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of chickpea cv. B-90 at Brooks, Alberta in 2000.

Treatment	Rate (g ai/100 kg seed)	No. seedlings /6m	Yield (T/ha)
APRON XL + MAXIM +*P*[1]	3.75 + 2.5	62.6 a[2]	3.47 ab
APRON MAXX +*P*	3.75 + 2.5	63.0 a	3.67 a
MAD[3] +*P*	22	62.3 a	3.89 a
MAD + CRUISER +*P*	22 + 50	63.9 a	3.62 a
VITAFLO 280 +*P*	88	42.4 b	3.51 ab
Control +*P*	--	2.9 d	0.96 c
Control	--	34.0 c	2.51 b

[1] Denotes inoculation with *Pythium*.

[2] Means within a column followed by the same letter are not significantly different for each experimental variable using Duncan's New Multiple Range Test (*P* 0.05).

[3] MAXIM+APRON XL+DIVIDEND.

2000 PMR REPORT # 101 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. B-90
PEST: Root rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF FUSARIUM ROOT ROT OF CHICKPEA IN ALBERTA IN 2000

MATERIALS: MAXIM 480 (fludioxonil, 480g/L FS), APRON XL (metalaxyl-M, 369 g ai/L LS), APRON MAXX 240.5 (metalaxyl-M, 13.6% + fludioxonil, 9.11% MEC), DIVIDEND (difenoconazole, 32.8% FS), CRUISER (thiamethoxam, 350 g/L FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of chickpea cv. B-90 was treated in a Hege small batch seed treater with APRON MAXX at 3.75 g ai/100 kg seed, a combination of MAXIM and APRON XL at 2.5 and 3.75 g ai/100 kg seed, a combination of MAXIM, APRON and DIVIDEND (MAD) at 2.5, 7.5 and 12 g ai/100 kg seed, respectively, alone and combined with CRUISER at 50 g ai/100 kg seed. Seed was also treated with VITAFLO 280 at 88 g ai/100 kg seed. An experimental plot was established on 18 May, 2000 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 4 cm deep at a rate of 75 seeds per row. *Fusarium avenaceum* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row (3×10^2 CFU/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted 3 weeks after seeding. At maturity (26 September), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: All treatments had significantly (*P* 0.05) higher seedling emergence and seed yield than the inoculated control, and all treatments except VITAFLO 280 had higher seedling emergence than the noninoculated control (Table 1). There were no significant differences in emergence or seed yield among the five chemical treatments.

CONCLUSIONS: Seedling emergence and seed yield were improved over the inoculated control by all fungicides tested in this trial.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of chickpea cv. B-90 at Brooks, Alberta in 2000.

Treatment	Rate	No. seedlings	Yield
	(g ai/100 kg seed)	/6m	(T/ha)
APRON XL + MAXIM +*F*[1]	7.5 + 2.5	43.6 a[2]	3.57 a
APRON MAXX +*F*	3.75	46.6 a	3.61 a
MAD[3] +*F*	7.5+2.5+12	47.4 a	3.57 a
MAD + CRUISER +*F*	7.5+2.5+25	48.0 a	3.06 a
VITAFLO 280 +*F*	88	36.0 b	3.18 a
Control +*F*	–	7.1 c	1.52 b
Control	–	33.3 b	3.33 a

[1] Denotes inoculation with *Fusarium*.

[2] Means within a column followed by the same letter are not significantly different for each experimental variable using Duncan's New Multiple Range Test (*P* 0.05).

[3] MAXIM+APRON XL+DIVIDEND.

2000 PMR REPORT # 102 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Milestone
PEST: Root Rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF FUSARIUM ROOT ROT OF LENTIL IN ALBERTA IN 2000

MATERIALS: MAXIM 480 (fludioxonil, 480g/L FS), APRON XL (metalaxyl-M, 369 g ai/L LS), APRON MAXX 240.5 (metalaxyl-M, 13.6% + fludioxonil, 9.11% MEC), DIVIDEND (difenoconazole, 32.8% FS), CRUISER (thiamethoxam, 350 g/L FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of lentil cv. Milestone was treated in a Hege small batch seed treater with APRON MAXX at 3.75 g ai/100 kg seed, a combination of MAXIM and APRON XL at 2.5 and 3.75 g ai/100 kg seed, and a combination of MAXIM, APRON and DIVIDEND (MAD) at 2.5, 7.5 and 12 g ai/100 kg seed, respectively, alone and combined with CRUISER at 50 g ai/100 kg seed. Seed was also treated with VITAFLO 280 at 88 g ai/100 kg seed. An experimental plot was established on 25 May, 2000 at Vegreville, Alberta, in black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 22 g of seed per row. *Fusarium avenaceum* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row (3 x 10^2 CFU/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted 4 weeks after seeding. At maturity (25 September), plants were hand-harvested. Seeds were threshed and weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence was significantly (P 0.05) greater for the chemical treatments, except MAD+CRUISER compared to the inoculated control (Table 1). There were no differences among the seed treatments with respect to emergence. Seed yield was significantly greater (P 0.05) for the APRON XL+MAXIM and AMD treatments than for the inoculated control. Yield was also greater for APRON XL+MAXIM compared to APRON MAXX and MAD+CRUISER.

CONCLUSIONS: All chemical treatments, except the MAD+CRUISER treatment, improved plant stands, but only APRON XL+MAXIM and MAD improved yield.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of lentil cv. Milestone at Vegreville, Alberta in 2000.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Yield (T/ha)
APRON XL + MAXIM +*F*[1]	3.75 + 2.5	47.3 b[2]	2.21 a
APRON MAXX +*F*	3.75 + 2.5	43.3 b	1.76 bc
MAD[3] +*F*	22	43.8 b	1.95 ab
MAD + CRUISER +*F*	22 + 50	40.1 bc	1.72 bc
VITAFLO 280 +*F*	88	40.9 b	1.89 abc
Control +*F*	--	30.6 c	1.50 c
Control	--	95.4 a	2.15 ab

[1] Denotes inoculation with *Fusarium*.

[2] Means within a column followed by the same letter are not significantly different for each experimental variable using Duncan's New Multiple Range Test (P 0.05).

[3] MAXIM+APRON XL+DIVIDEND.

2000 PMR REPORT # 103 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cvs. Eston and Laird
PEST: Root Rot, *Rhizoctonia solani* Kühn.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF LENTIL IN 2000

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L FL), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), LS 176, APRON FL (metalaxyl, 317 g/L SN)

METHODS: Seed of lentil cvs. Eston and Laird was treated with VITAFLO 280 at 3.3 mL/kg seed, CROWN at 3.0 and 6.0 mL/kg seed and a combination of LS 176 and APRON FL at 3.1 and 0.16 mL/kg seed, respectively in a Hege II small batch seed treater. Experimental plots were established on 24 May at Vegreville, Alberta in black chernozemic sandy loam soil. Plots were seeded in a split-plot randomized complete block design with four replications. Lentil cultivars served as main plots and fungicide seed treatment, along with *Rhizoctonia*-inoculated and non-inoculated controls, served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 20 g per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted for each subplot three weeks after seeding. At maturity (26 September), plants from the middle 5 m of each plot were hand-harvested. Seeds were threshed and weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence for all seed treatments tested was significantly greater (*P* 0.05) than for the inoculated control. Where CROWN was applied at 6.0 mL/kg, stand counts were significantly greater than for CROWN at the lower rate and for LS176 + APRON. Seed yield for every treatment, except CROWN applied at the lower rate, was significantly greater compared to the inoculated control. CROWN applied at the higher rate showed significantly greater yield than any other treatment, and produced a yield similar to that of the noninoculated control. Yield for VITAFLO 280 was significantly (*P* 0.05) greater than that of CROWN applied at the lower rate, but not significanly different from the LS 176 + APRON treatment. Stands were similar between the two cultivars, but yield was greater in Eston than in Laird.

CONCLUSIONS: All seed treatments improved seedling emergence and most improved yield relative to the inoculated control. CROWN applied at the higher rate had the most positive effect on both emergence and yield; however, at the lower rate, it had less positive effects on emergence and no effect on yield. The effects of VITAFLO 280 and LS 176 + APRON were intermediate between the two rates of CROWN.

Table 1. Effects of fungicidal seed treatments on seedling survival and seed yield of lentil cvs. Eston and Laird at Vegreville, Alberta in 2000.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
VITAFLO 280 +*R*[1]	3.3	18.5 bc[2]	1.04 b
CROWN +*R*	3	14.1 c	0.72 cd
CROWN +*R*	6	23.3 b	1.30 a
LS 176+ APRON +*R*	3.1 + 0.16	13.7 c	0.94 bc
Control +*R*	–	5.2 d	0.68 d
Control	–	88.0 a	1.51 a

[1] Denotes inoculation with *Rhizoctonia solani*.

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

Table 2. Comparison of seedling establishment and seed yield of lentil cvs. Eston and Laird at Vegreville, Alberta in 2000.

Cultivar	Stand (plants/6m)	Seed yield (T/ha)
Eston	27.0 a[1]	1.12 a
Laird	27.3 a	0.99 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (P 0.05).

2000 PMR REPORT # 104 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Milestone
PEST: Root rot, *Rhizoctonia solani* Kuhn.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA ROOT ROT OF LENTIL IN ALBERTA IN 2000

MATERIALS: MAXIM 480 (fludioxonil, 480g/L FS), APRON XL (metalaxyl-M, 369 g ai/L LS), APRON MAXX 240.5 (metalaxyl-M, 13.6% + fludioxonil, 9.11% MEC), DIVIDEND (difenoconazole, 32.8% FS), CRUISER (thiamethoxam, 350 g/L FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of lentil cv. Milestone was treated in a Hege small batch seed treater with APRON MAXX at 3.75 g ai/100 kg seed, a combination of MAXIM and APRON XL at 2.5 and 3.75 g ai/100 kg seed, and a combination of MAXIM, APRON and DIVIDEND (MAD) at 2.5, 7.5 and 12 g ai/100 kg seed, respectively, alone and combined with CRUISER at 50 g ai/100 kg seed. Seed was also treated with VITAFLO 280 at 88 g ai/100 kg seed. An experimental plot was established on 29 May, 2000 at Vegreville, Alberta, in black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 22 g of seed per row. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row (3 x 10^2 CFU/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted 4 weeks after seeding. At maturity (18 September), plants were hand-harvested. Seeds were threshed and weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence and seed yield in plots treated with VITAFLO 280 were significantly (P 0.05) greater than the inoculated control (Table 1). Yield was also greater than the inoculated control where the MAD+CRUISER formulation was applied, but seedling emergence was not.

CONCLUSIONS: Plant stand and yield were improved by VITAFLO 280. Yield was also improved by MAD+CRUISER.

Table 1. Effect of seed treatments on plant stand and seed yield of lentil cv. Milestone at Vegreville, Alberta in 2000.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Yield (T/ha)
APRON XL + MAXIM +*R*[1]	3.75 + 2.5	8.1 c[2]	0.93 bc
APRON MAXX +*R*	3.75	7.0 c	0.96 bc
MAD[3] +*R*	22	10.9 c	1.29 bc
MAD + CRUISER +*R*	22 + 50	10.6 c	1.49 b
VITAFLO 280 +*R*	88	17.6 b	1.50 b
Control +*R*	–	5.9 c	0.82 c
Control	–	104.9 a	2.67 a

[1] Denotes inoculation with *Rhizoctonia*.

[2] Means within a column followed by the same letter are not significantly different for each experimental variable using Duncan's New Multiple Range Test (*P* 0.05).

[3] MAXIM+APRON XL+DIVIDEND.

2000 PMR REPORT # 105 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 6100[illegible]653

CROP: Field pea (*Pisum sativum* L.), cvs. Carneval and Carrera
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF FIELD PEA IN 2000

MATERIALS: APRON FL (metalaxyl, 317 g/L SN), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), CAPTAN 400 (Captan, 457g/L SU), LS 176

METHODS: Seed of pea cvs. Carneval and Carrera was treated with VITAFLO 280 at 2.6 and 3.3 mL/kg seed, a combination of VITAFLO 280 and APRON FL at 2.6 and 0.16 mL/kg seed, respectively, CAPTAN at 2.1 mL/kg seed, and a combination of LS 176 and APRON FL at 3.1 and 0.16 mL/kg seed, respectively, in a Hege II small batch seed treater. Experimental plots were established on 26 May at Vegreville, Alberta in black chernozemic sandy loam soil. Plots were seeded in a split-plot randomized complete block design with four replications. Pea cultivars served as main plots and fungicide seed treatment, along with *Rhizoctonia*-inoculated and non-inoculated controls, served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 20 g per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted for each subplot three weeks after seeding. At maturity (7 September), plants were harvested by small plot combine. Seeds were dried and weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence in treated plots was significantly (P 0.05) greater than the inoculated control for all treatments, except CAPTAN, which produced fewer seedlings than any other treatments (Table 1). Seed yield was significantly (P 0.05) greater than the inoculated control for all seed treatments. There were no significant yield differences among the treatments. Both cultivars showed similar levels of seedling establishment, but Carrera produced more seed than Carneval (Table 2).

CONCLUSIONS: All seed treatments, except CAPTAN, improved plant stand, and all treatments in the trial improved yield over the inoculated control.

Table 1. Effects of fungicidal seed treatments on seedling survival and seed yield of pea cvs. Carneval and Carrera at Vegreville, Alberta in 2000.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
VITAFLO 280 +*R*[1]	2.6	35.6 b[2]	2.51 ab
VITAFLO +*R*	3.3	35.6 b	2.42 ab
VITAFLO + APRON +*R*	2.6 + 0.16	34.7 b	2.74 ab
LS 176 + APRON +*R*	3.1 + 0.16	31.2 b	2.25 b
CAPTAN +*R*	2.1	21.4 c	2.33 b
Control +*R*	–	16.6 c	1.66 c
Control	–	51.1 a	2.88 a

[1] Denotes inoculation with *Rhizoctonia solani*.

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

Table 2. Comparison of seedling establishment and seed yield of field pea cvs. Carneval and Carrera at Vegreville, Alberta in 2000.

Cultivar	Stand (plants/6m)	Seed yield (T/ha)
Carneval	31.8 a[1]	2.19 b
Carrera	32.8 a	2.61 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (P 0.05).

2000 PMR REPORT # 106 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Pea (*Pisum sativum* L), cv. Delta
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA ROOT ROT OF PEA IN ALBERTA IN 2000

MATERIALS: MAXIM 480 (fludioxonil, 480g/L FS), APRON XL (metalaxyl-M, 369 g ai/L LS), APRON MAXX 240.5 (metalaxyl-M, 13.6% + fludioxonil, 9.11% MEC), DIVIDEND (difenoconazole, 32.8% FS), CRUISER (thiamethoxam, 350 g/L FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of pea cv. Delta was treated in a Hege small batch seed treater with APRON MAXX at 3.75 g ai/100 kg seed, a combination of MAXIM and APRON XL at 2.5 and 3.75 g ai/100 kg seed, and a combination of MAXIM, APRON and DIVIDEND (MAD) at 2.5, 7.5 and 12 g ai/100 kg seed, respectively, alone and combined with CRUISER at 50 g ai/100 kg seed. Seed was also treated with VITAFLO 280 at 88 g ai/100 kg seed. An experimental plot was established on 29 May, 2000 at Vegreville, Alberta, in black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 22 g of seed per row. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row (3 x 10^2 CFU/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted 3 weeks after seeding. At maturity (8 September), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence was significantly (*P* 0.05) greater than the inoculated control for all treatments, except APRON XL+MAXIM and APRON MAXX (Table 1). Emergence for MAD+CRUISER was significantly (*P* 0.05) greater than for treatments that did not include MAD. Seed yield was significantly (*P* 0.05) greater than the inoculated control for all chemical treatments, and was greater for MAD+CRUISER than for APRON MAXX and VITAFLO 280.

CONCLUSIONS: MAD and VITAFLO 280 improved plant stand and all of the treatments in the trial improved yield. Treatments with MAD and APRON +MAXIM resulted in the greatest improvement in yield over the inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of pea cv. Delta at Vegreville, Alberta in 2000.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Yield (T/ha)
APRON XL + MAXIM +*R*[1]	3.75 + 2.5	10.1 cde[2]	1.93 abc
APRON MAXX +*R*	3.75 + 2.5	8.6 de	1.74 c
MAD[3] +*R*	22	16.3 bc	2.36 ab
MAD+ CRUISER +*R*	22 + 50	19.3 b	2.40 a
VITAFLO 280 +*R*	88	12.2 cd	1.84 bc
Control +*R*	--	5.2 e	0.70 d
Control	--	42.6 a	2.45 a

[1] Denotes inoculation with *Rhizoctonia*

[2] Means within a column followed by the same letter are not significantly different for each experimental variable using Duncan's New Multiple Range Test (*P* 0.05).

[3] MAXIM+APRON XL+DIVIDEND

2000 PMR REPORT # 107 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Carrera
PEST: Mycosphaerella Blight, *Mycosphaerella pinodes* Berk. & Blox.

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TITLE: EVALUATION OF FOLIAR SPRAY FORMULATIONS FOR THE CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA IN ALBERTA IN 2000

MATERIALS: DITHANE RAINSHIELD NT (mancozeb 75% DG), BRAVO 500F (chlorothalonil, 500 g/L SU).

METHODS: Experimental plots were established on 27 May, 2000 at Vegreville, Alberta, in black chernozemic sandy loam soil. Field pea cv. Carrera was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 22 g per row. Foliar fungicide treatments (DITHANE RAINSHIELD NT and BRAVO 500F applied at 1500 and 1000 g ai/ha) were applied on 17 and 31 July using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom using 1000 L/ha water volume. Mycosphaerella blight severity was rated on 28 August at 5 sites per plot on a 0-9 scale based on percent foliar infection for the upper, middle and lower leaves and on a 0-9 scale for the stem based on lesion size and abundance. At maturity, on 13 September, plants from each plot were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Foliar disease severity was significantly lower (P 0.05) than the untreated control where plots were treated once with BRAVO or twice with either BRAVO or DITHANE (Table 1). Stem disease severity was lower than the untreated control where two applications of either fungicide were made. No significant differences occurred among the fungicide treatments with respect to either foliar or stem disease severity. Seed yields among the treatments and the untreated control were not significantly different.

CONCLUSIONS: Two applications of BRAVO or DITHANE reduced disease severity on both leaves and stems but a single application of BRAVO reduced only foliar disease severity. Seed yield was increased by the application of either foliar fungicide, but these differences were not significantly better than the untreated control.

Table 1. Effect of foliar spray treatments on the severity of Mycosphaerella blight and seed yield of field pea cv. Carrera at Vegreville in 2000.

Treatment	Timing	Disease severity (0-9)		Yield
		Leaf	Stem	(T/ha)
Control	–	6.5 a[1]	4.3 a	1.98
DITHANE	A[2]	5.3 ab	3.7 ab	2.60
BRAVO 500 F	A	5.0 b	3.8 ab	2.80
DITHANE	A+B	4.0 b	3.2 b	2.49
BRAVO 500 F	A+B	4.0 b	3.1 b	2.28
ANOVA (P 0.05)		s	s	ns

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

[2] A- Foliar fungicide applied on 17 July; B- Foliar fungicide applied on 31 July.

2000 PMR REPORT # 108 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Carrera
PEST: Mycosphaerella Blight, *Mycosphaerella pinodes* Berk. & Blox.

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TITLE: EFFICACY OF FOLIAR SPRAY FORMULATIONS AGAINST MYCOSPHAERELLA BLIGHT OF FIELD PEA IN ALBERTA IN 2000

MATERIALS: TILT (propiconazole, 250 g/L EC), FLINT (CGA-279202, 125 g/L EC), BRAVO 500F (chlorothalonil, 500 g/L SU).

METHODS: Experimental plots were established on 27 May, 2000 at Vegreville, Alberta, in black chernozemic sandy loam soil. Field pea cv. Carrera was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 22 g per row. Foliar fungicide treatments TILT 250 EC and FLINT 125 (at 125 g ai/ha) and BRAVO 500F (at 1500 g ai/ha) were applied on 21 July using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom using 1000 L/ha water volume. TILT 250 and FLINT 125 were also applied at the same rates to selected plots on 31 July and 10 August. Mycosphaerella blight severity was rated at 5 sites per plot on 21 August on a 0-9 scale based on percent foliar infection for the upper, middle and lower leaves and on a 0-9 scale for the stem based on lesion size and abundance. At maturity, on 13 September, plants from each plot were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Overall foliar disease severity was significantly (P 0.05) lower than the untreated control where TILT was applied early, in the BRAVO treatment, and in all treatments where FLINT was applied, except for the single application at mid-bloom (Table 1). There were no significant differences in foliar disease severity among the fungicide treatments. Disease severity on stems was lower than the control for all FLINT treatments, the BRAVO treatment, and the early+mid and mid-bloom TILT treatments. Where FLINT was applied on all three dates, stem disease severity was lower than where it was applied at late bloom or at mid+late bloom. There were no significant differences in stem disease severity among the TILT treatments. Yield for all treatments was similar to the untreated control.

CONCLUSIONS: TILT and BRAVO reduced foliar disease severity when applied at early bloom, while FLINT was effective across a broad range of application timing. FLINT had the greatest effect on stem disease severity when applied at early bloom. None of the fungicide applications affected yield.

Table 1. Effect of foliar spray treatments on the severity of Mycosphaerella blight and seed yield of field pea cv. Carrera at Vegreville in 2000.

Treatment	Spray timing	Disease severity (0-9) Leaf	Disease severity (0-9) Stem	Yield (T/ha)
Control		6.0 a[1]	5.5 a	2.28
TILT 250 EC	E[2]	4.5 b	4.4 abc	2.30
TILT 250 EC	E+M	4.3 b	4.3 bcd	2.23
TILT 250 EC	E+M+L	4.0 b	4.7 ab	2.40
TILT 250 EC	M	5.3 ab	4.1 bcd	2.70
TILT 250 EC	M+L	5.0 ab	5.1 ab	2.41
TILT 250 EC	L	5.3 ab	4.5 abc	2.70
FLINT 125 EC	E	4.5 b	3.3 cde	2.25
FLINT 125 EC	E+M	4.0 b	3.1 de	2.28
FLINT 125 EC	E+M+L	4.3 b	2.6 e	2.34
FLINT 125 EC	M	5.0 ab	3.4 cde	2.11
FLINT 125 EC	M+L	4.3 b	4.1 bcd	2.07
FLINT 125 EC	L	4.8 b	4.3 bc	2.39
BRAVO 500 F	E	4.3 b	4.0 bcd	2.54
ANOVA (P 0.05)		s	s	ns

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[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

[2] E - Foliar fungicide applied on 21 July; M - Foliar fungicide applied on 31 July; L - Foliar fungicide applied on 10 August.

2000 PMR REPORT # 109 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Carrera
PEST: Powdery Mildew, *Erysiphe pisi* Syd.

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TITLE: EVALUATION OF FOLIAR SPRAY FORMULATIONS FOR THE CONTROL OF POWDERY MILDEW OF FIELD PEA IN ALBERTA IN 2000

MATERIALS: NOVA 40W (myclobutanil, 40% WP), KUMULUS 80 (sulfur, 80% DF).

METHODS: Experimental plots were established on 5 June, 2000 at Vegreville, Alberta, in black chernozemic sandy loam soil. Field pea cv. Carrera was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 22 g per row. Foliar fungicide treatments (NOVA 40W applied at 56 g ai/ha and KUMULUS 80 DF applied at 1200 g ai/ha) were applied on 31 July and 15 August using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa using 200 L/ha water volume. TILT 250 and FLINT 125 were also applied at the same rates to selected plots on 10 and 21 August. Powdery mildew severity was rated on 6 September at 5 sites per plot on a 0-9 scale based on percent foliar infection(0= no infection, 1=trace infection, 2=1-2% of leaf area infected, 4=3-5% infected, 5=5-10% infected, 6=10-25% infected, 7=50-75% infected, 8=75-90% infected, 9=90-100% infected). At maturity, on 13 September, plants from each plot were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Although powdery mildew occurred at very low levels, disease severity on leaves was significantly (*P* 0.05) lower in plots treated with both early and late spray treatments of NOVA and KUMULUS and in plots sprayed with KUMULUS at the early date, than in control plots (Table 1). However, yield was significantly (*P* 0.05) lower in plots sprayed at both dates than in plots sprayed with KUMULUS alone at the early date.

CONCLUSIONS: Both NOVA and KUMULUS reduced powdery mildew severity compared with untreated plots when sprayed at both early and late dates. When sprayed at the early date, KUMULUS reduced disease severity from levels found in untreated controls, and it improved seed yield over either KUMULUS or NOVA sprayed at both dates.

Table 1. Effect of foliar spray treatments on the severity of powdery mildew and seed yield of field pea cv. Carrera at Vegreville in 2000.

Treatment	Timing	Disease severity (0-9)	Yield (T/ha)
Control	--	2.7 a[1]	1.85 ab
NOVA 40 W	A[2]	1.6 ab	1.85 ab
KUMULUS	A	1.3 b	2.02 a
NOVA 40 W	A+B	1.0 b	1.53 b
KUMULUS	A+B	1.2 b	1.63 b
ANOVA (P 0.05)		s	s

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

[2] A-foliar fungicide applied on 31 July; B-foliar fungicide applied on 15 August.

2000 PMR REPORT # 110 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Carrera
PEST: Powdery Mildew, *Erysiphe pisi* Syd.

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TITLE: EFFICACY OF FOLIAR SPRAY FORMULATIONS AGAINST POWDERY MILDEW OF FIELD PEA IN ALBERTA IN 2000

MATERIALS: TILT (propiconazole, 250 g/L EC), FLINT (CGA-279202, 125 g/L EC), BRAVO 500F (chlorothalonil, 500 g/L SU).

METHODS: Experimental plots were established on 5 June, 2000 at Vegreville, Alberta, in black chernozemic sandy loam soil. Field pea cv. Carrera was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 22 g per row. Foliar fungicide treatments TILT 250 EC and FLINT 125 (at 125 g ai/ha) and BRAVO 500F (at 1500 g ai/ha) were applied on 31 July using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom using 1000 L/ha water volume. TILT 250 and FLINT 125 were also applied at the same rates to selected plots on and 10 and 21 August. Powdery mildew severity was rated on 6 September at 5 sites per plot on a 0-9 scale based on percent foliar infection (0= no infection, 1=trace infection, 2=1-2% of leaf area infected, 4=3-5% infected, 5=5-10% infected, 6=10-25% infected, 7=50-75% infected, 8=75-90% infected, 9=90-100% infected). At maturity, on 13 September, plants from each plot were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Disease severity was significantly lower than in the untreated control for all treatments except the early applications of TILT and BRAVO (Table 1). For both TILT and FLINT, disease severity was lowest where the fungicides were applied at all three dates, but there were no significant differences among the FLINT treatments. Disease severity was lower for all FLINT treatments compared to BRAVO. For TILT, disease severity was lower for the mid + late application than for the early application. Except for the mid + late and late applications, disease severity was lower in plots treated with FLINT than in plots treated with the equivalent application timing of TILT. Seed yield was similar to the nontreated control for all fungicide treatments.

CONCLUSIONS: FLINT reduced disease severity across a broad range of spray application timing, while late applications of TILT reduced disease severity more than early applications. Early application of BRAVO did not reduce disease severity. The foliar fungicides tested did not affect seed yield relative to untreated plots.

Table 1. Effect of foliar spray treatments on the severity of powdery mildew and seed yield of field pea cv. Carrera at Vegreville in 2000.

Treatment	Timing	Disease severity (0-9)	Yield (T/ha)
Control		2.6 a[1]	1.21 ab
TILT 250 EC	E[2]	2.1 ab	1.39 ab
TILT 250 EC	E+M	1.5 bcde	1.26 ab
TILT 250 EC	E+M+L	1.0 def	1.49 ab
TILT 250 EC	M	1.6 bcd	1.55 ab
TILT 250 EC	M+L	1.3 cdef	1.19 ab
TILT 250 EC	L	1.4 bcdef	1.60 ab
FLINT 125 EC	E	0.6 fg	1.14 b
FLINT 125 EC	E+M	0.6 fg	1.24 ab
FLINT 125 EC	E+M+L	0.1 g	1.54 ab
FLINT 125 EC	M	0.8 efg	1.66 a
FLINT 125 EC	M+L	0.6 fg	1.37 ab
FLINT 125 EC	L	0.6 fgb	1.43 ab
BRAVO 500F	E	2.0 abc	1.23 ab
ANOVA (P 0.05)		s	s

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

[2] E - Foliar fungicide applied on 31 July; M - Foliar fungicide applied on 10 August; L - Foliar fungicide applied on 21 August.

2000 PMR REPORT # 111 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.)
PEST: Ascochyta Blight, *Ascochyta pisi* (Pass.) Lab.

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TITLE: IN VITRO EVALUATION OF FUNGICIDES FOR THE INHIBITION OF *ASCOCHYTA PISI*

MATERIALS: TILT 250 (propiconazole, 250 g/L EC), STRATEGO 250 (propiconazole + CGA-279202, 125 + 125 g/L EC), FLINT 125 (CGA-279202, 125 g/L EC), Fludioxonil 50 (50 % WP), QUADRIS 250 (azoxystrobin, 250 g/L SU), ACTIGARD 50 (CGA-245704, 50% WG) and BRAVO 500 F (chlorothalonil 500 g/L SU).

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing *Ascochyta pisi* on potato-dextrose agar (PDA) plates amended with TILT, STRATEGO, FLINT, Fludioxonil, QUADRIS, ACTIGARD and BRAVO, respectively. The final concentration of fungicides in the plates was adjusted to 0.001, 0.01, 0.05, 0.1, 0.25 and 0.5 µg/mL. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *A. pisi*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 C. A completely randomized design was used. Colony diameters were measured every 24 hr until the non-fungicide control plates were fully overgrown. Each treatment was tested on 10 plates and the bioassay was repeated once. Data were transformed to percent inhibition of mycelial growth by comparing with non-amended controls, and subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System (SAS Institute, Cary, NC).

RESULTS: TILT had the highest suppressive effect to *Ascochyta* growth on the PDA plates (Figure 1,Table 1). It inhibited colony growth by over 80% at the concentration of 0.05 µg/mL and completely inhibited growth when the concentration was above 0.1 µg/mL. STRATEGO, QUADRIS and fludioxonil reached similar levels of inhibition at higher concentrations, but overall efficacy was lower than TILT. ACTIGARD had the lowest inhibitory effect among the seven fungicides with 11% inhibition at the highest concentration. FLINT and BRAVO achieved approximately 50% inhibition of colony growth at 0.5 µg/mL.

CONCLUSIONS: TILT was the most effective fungicide for controlling *Ascochyta* growth. STRATEGO, QUADRIS and fludioxonil also show potential for ascochyta blight management at relatively higher concentrations. ACTIGARD is not suitable for controlling this disease according to our *in vitro* bioassays.

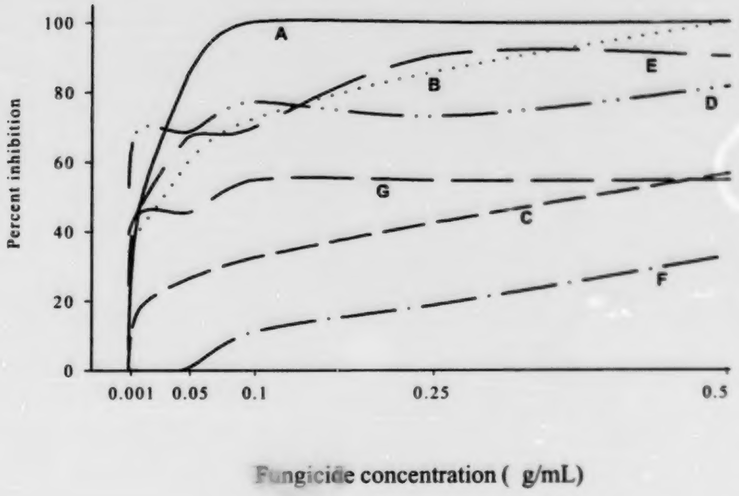

Figure 1. Dose-response of *Ascochyta pisi* to seven fungicides in potato-dextrose agar. (A) TILT 250 EC, (B) STRATEGO 250 EC, (C) FLINT 125 EC, (D) Fludioxomil 50 WP, (E) QUADRIS 250 SC, (F) ACTIGARD 50 WG, and (G) BRAVO 500 F.

Table 1. Inhibitory effects of seven fungicides on *Ascochyta pisi* in an *in vitro* bioassay.

Treatment	Inhibition of mycelial growth (%)*
TILT 250 EC	73.2 a
STRATEGO 250 EC	65.4 d
FLINT 125 EC	29.2 f
Fludioxonil 50 WP	70.5 b
QUADRIS 250 SC	67.1 c
ACTIGARD 50 WG	10.5 g
BRAVO 500 F	46.5 e

[1] Values are means of ten replications in each of six concentration levels of each fungicide. Means within a column followed by a common letter are not significantly different according to least significant difference at *P* 0.05.

2000 PMR REPORT # 112 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.)
PEST: Fusarium Root Rot, *Fusarium avenaceum* (Fr.) Sacc.
Pythium Root Rot, *Pythium ultimum* Trow.
Rhizoctonia Root Rot, *Rhizoctonia solani* Kühn.

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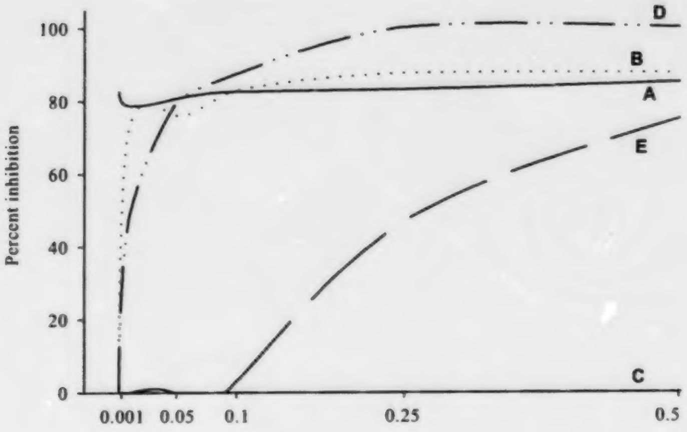
TITLE: IN VITRO EVALUATION OF FUNGICIDES FOR INHIBITION OF ROOT ROT - CAUSING FUNGI

MATERIALS: MAXIM 480 (fludioxonil 480g/L FS), DIVIDEND 360 (difeconazole 360 g a.i./L FS), APRON XL LS (metalaxyl-M, 369 g ai/L LS), MAD 96 (MAXIM 8.4% + APRON 32.7% + DIVIDEND 58.9% FS), VITAFLO 280 FS (thiram 130 g a.i/L + carbathiin 150 g a.i. /L SU)

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing *Fusarium avenaceum*, *Pythium ultimum* and *Rhizoctonia solani* on potato-dextrose agar (PDA) plates amended with MAXIM, DIVIDEND, APRON, MAD and VITAFLO, respectively. The final concentration of fungicides in the plates was adjusted to 0.001, 0.01, 0.05, 0.1, 0.25 and 0.5 µg/mL. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *Fusarium*, *Pythium* and *Rhizoctonia*. The plugs were inserted into the center of the bioassay plates, which were then incubated at 20-25 C. A completely randomized design was used. Colony diameters were measured every 24 hr until the non-fungicide control plates were fully overgrown. Each treatment was tested on 10 plates and the bioassay was repeated once. Data were transformed to percent inhibition of mycelial growth by comparing with non-amended controls, and subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System (SAS Institute, Cary, NC).

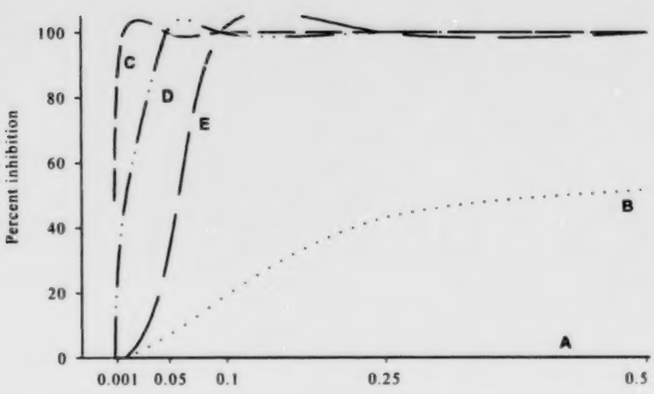
RESULTS: There were statistically significant (P 0.05) differences among fungicides for controlling *Fusarium*, *Pythium*, and *Rhizoctonia* according to our in vitro bioassays (Figures 1 - 3 and Table 1). In the case of *Fusarium*, MAD, DIVIDEND and MAXIM suppressed over 80% of mycelial growth on the PDA plates at 0.5 µg/mL. Although VITAFLO produced 75% inhibition at 0.5 µg/mL, it had no effect at concentrations lower than 0.1 µg/mL. APRON had no effect on *Fusarium* and little effect on *Rhizoctonia*. The three fungicides APRON, MAD and VITAFLO were highly suppressive to *Pythium* mycelial growth when incorporated into PDA plates, but VITAFLO had little effect at or below 0.05 µg/mL. DIVIDEND achieved 50% inhibition at higher concentrations, while MAXIM had no effect on *Pythium* growth. MAXIM was the best fungicide for controlling *Rhizoctonia* and completely inhibitedcolony growth even at the lowest concentration. MAD and VITAFLO were also effective fungicides for *Rhizoctonia* with 100% inhibition at concentrations above 0.1 µg/mL. APRON and DIVIDEND were the least effective among the fungicides tested in this trial.

CONCLUSIONS: MAD, DIVIDEND and MAXIM were effective fungicides for controlling *Fusarium*; APRON, MAD and VITAFLO were effective against *Pythium*; and MAXIM, MAD and VITAFLO were effective against *Rhizoctonia*. MAXIM was not effective for *Pythium*, and APRON had no effect on either *Fusarium* or *Rhizoctonia* in our *in vitro* bioassays.



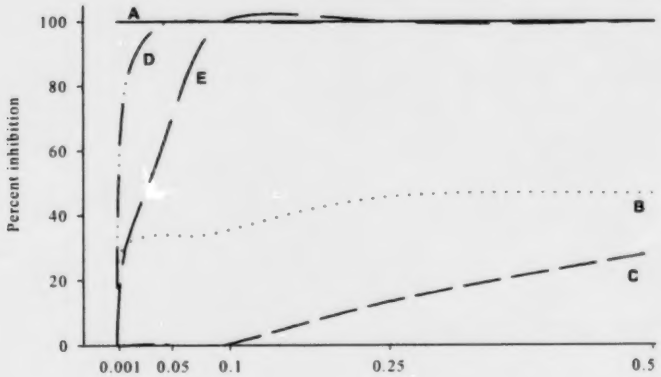
Fungicide concentration (g/mL)

Figure 1. Dose-response of *Fusarium* spp. to five fungicides in potato-dextrose agar. (A) MAXIM 480 FS, (B) DIVIDEND 360 FS, (C) APRON XL LS, (D) MAD 96 FS, and (E) VITAFLO 280 FS.



Fungicide concentration (g/mL)

Figure 2. Dose-response of *Pythium* spp. to five fungicides in potato-dextrose agar. (A) MAXIM 480 FS, (B) DIVIDEND 360 FS, (C) APRON XL LS, (D) MAD 96 FS, and (E) VITAFLO 280 FS.



Fungicide concentration (g/mL)

Figure 3. Dose-response of *Rhizoctonia solani* to five fungicides in potato-dextrose agar. (A) MAXIM 480 FS, (B) DIVIDEND 360 FS, (C) APRON XL LS, (D) MAD 96 FS, and (E) VITAFLO 280 FS.

Table 1. Effects of five fungicides on growth of *Fusarium*, *Pythium* and *Rhizoctonia* in *in vitro* bioassays.

Treatment	Inhibition of mycelial growth (%)[1]		
	Fusarium	*Pythium*	*Rhizoctonia*
MAXIM 480 FS	82.1 a	0 e	100.0 a
DIVIDEND 360 FS	68.1 b	19.9 d	35.4 d
APRON XL LS	0 d	91.4 a	6.9 e
MAD 96 FS	69.0 b	74.4 b	83.2 b
VITAFLO	20.4 c	55.0 c	66.5 c

[1] Values are means of ten replications in each of six concentration levels of each fungicide. Means within a column followed by a common letter are not significantly different according to least significant difference at P 0.05.

2000 PMR REPORT # 113 **SECTION L: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Soybean (*Glycine max* L.), cvs. Gailland and Mario
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF SOYBEAN IN 2000

MATERIALS: APRON FL (metalaxyl, 317 g/L SN), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), LS 176, CAPTAN 400 (Captan, 457 g/L SU)

METHODS: Seed of soybean cvs. Gaillard and Mario was treated with VITAFLO 280 at 2.6 mL/kg, CAPTAN 400 at 2.1 mL/kg seed, VITAFLO 280 + APRON FL at 2.6 and 0.05 mL/kg seed, respectively, and a combination of LS 176 and APRON FL at 3.1 and 0.16 mL/kg seed, respectively, in a Hege II small batch seed treater. Experimental plots were established on 19 May at Brooks, Alberta in brown chernozemic clay loam soil. Plots were seeded in a split-plot randomized complete block design with four replications. Soybean cultivars served as main plots and fungicide seed treatment, along with *Rhizoctonia*-inoculated and non-inoculated controls, served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted for each subplot three weeks after seeding. Plants of cv. Gaillard were combined on 29 September using a small plot combine and plants of cv. Mario were hand-harvested on 28 September, dried, and threshed on 13 October. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence and seed yield were significantly greater (P 0.05) for all seed treatments tested compared to the inoculated control. Plant stand and seed yield were significantly greater (P 0.05) for the seed treatments containing VITAFLO 280 than for the other two treatments in the trial. Stand was significantly greater (P 0.05) for the LS 176 treatment than for CAPTAN 400, but seed yield was similar for the two treatments (Table 1). Gaillard produced a better stand and yield than Mario (Table 2).

CONCLUSIONS: All seed treatments in the trial improved seedling emergence and seed yield over the nontreated inoculated control. VITAFLO 280 showed the greatest improvement among the seed treatments, both in seedling emergence and seed yield. LS 176 and CAPTAN 400 improved plant stand and seed yield to a lesser extent and LS 176 showed greater seedling establisment than the CAPTAN 400 treatment.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of soybean cvs. Gailland and Mario at Brooks, Alberta in 2000.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Control +*R*[1]	-	4.7 e[2]	0.42 c
VITAFLO 280 +*R*	2.6	36.0 b	2.23 a
VITAFLO 280 + APRON +*R*	2.6 + 0.05	38.8 b	2.11 a
LS 176 + APRON +*R*	3.1 + 0.16	21.5 c	1.39 b
CAPTAN 400 +*R*	2.1	12.7 d	1.16 b
Control	-	45.3 a	2.51 a

[1] Denotes inoculation with *Rhizoctonia solani*.

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P* 0.05).

Table 2. Comparison of plant stand and seed yield of soybean cvs. Gailland and Mario at Brooks, Alberta in 2000.

Cultivar	Stand (plants/6m)	Seed Yield (T/ha)
Gaillard	30.3 a[1]	1.83 a
Mario	22.7 b	1.45 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (P 0.05).

END OF SECTION L
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SECTION M:	**POTATOES - Diseases** **/LES MALADIES DES POMMES DE TERRES**
REPORT /RAPPORT #:	**114 - 117**
PAGES:	**286 - 294**
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2000 PMR Report # 114 **SECTION M: POTATOES - Diseases.**
STUDY DATA BASE: 303-1251-9601

CROP: Potato (*Solanum tuberosum* L.) cv. Russet Burbank
PEST: Black scurf (*Rhizoctonia solani* Kühn)
Silver scurf (*Helminthosporium solani* Dur. and Mont.)
Dry rot (*Fusarium* spp.)
Common scab (*Streptomyces scabies*)

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TITLE: EVALUATION AND COMPARISON OF MAXIM AND OTHER POTATO SEED PIECE TREATMENT FUNGICIDES FOR CONTROL OF BLACK SCURF, SILVER SCURF, DRY ROT AND COMMON SCAB OF POTATOES, 1999-2000.

MATERIALS: MAXIM® (fludioxonil 0.33%, 0.5% PSPT; Novartis); MAXIM MZ (fludioxonil 0.5% PSPT; Novartis; Canadian Formulation); MAXIM MZ ((fludioxonil 0.5% PSPT; Novartis; US UAP Formulation); DIVIDEND/MAXIM® (difenaconazole/fludioxonil 1.00%/0.5% PSPT; Novartis);DIVIDEND® (difenaconazole 1.00% PSPT; Novartis); EASOUT (thiophanate-methyl 10% PSPT, Novartis); and TUBERSEAL (mancozeb + Douglas Fir bark 12% PSPT, Novartis). The rate of application for each of the fungicides is presented in Table 1.

METHODS: Efficacy of seed piece treatment fungicides in reducing black scurf, silver scurf, dry rot and common scab of potato was evaluated at the Crops and Livestock Research Centre's Research Farm in Harrington, PEI in 1999. Seed pieces of potato cv.Russet Burbank, with 3.8% average initial black scurf incidence (percent tuber area covered with sclerotia), were treated with the appropriate fungicide in a plastic bag for a minimum of 2 minutes, and planted within two hours of the treatment. Untreated and inoculated untreated checks received no fungicides. For inoculated check, 40.0 g of wheat seed with *R. solani* inoculum was placed on the seed piece, and seed piece and inoculum were covered with soil immediately after inoculation. The seed was planted in rows 0.90 m apart with seed spacing of 0.45 m. Each of the plots were 13.0 m long and 4 rows wide, the middle two rows (58 seed pieces) received treatments while out side rows were used as guards. Each treatment was replicated 4 times in a randomized complete block design. Fertilizers, herbicides, insecticides and late blight fungicides were applied as and when required, at standard recommended rates (Publ. 1300A, Potato crop: variety, weed and pest control guide 1999 for the Atlantic Provinces). Plant emergence counts were taken on 31 May 1999 (2 wk), 7 June 1999 (3 wk), 14 June 1999 (4 wk), 21 June 1999 (5 wk), 16 July, 1999 (final); June 15 1999 (vigour 1), June 21, 1999 (vigour 2). Stem counts were made on 16 June 1999 (stem count 1), 14 Sept, 1999 (stem count 1), and stem stems were rated for rhizoctonia stem canker on 22 June 1999. Stolons were counted on 22 June, 1999 and rated for rhizoctonia disease on 22 June, 1999. Potatoes were harvested on 28 September, 1999 and yields were recorded. Fifty potatoes from each treatment were rated for all 4 diseases soon after harvest (18-19, October, 1999). Percent area covered by rhizoctonia sclerotia was assessed and recorded under 4 categories, 0 = Trace (1.0% infected); 1 = light (1-5% infected), 2 = Moderate (6-10% infected) and 3= Severe (>10% infected). Lesion area index was calculated by

$$\text{LAI} = \frac{\text{Sum of total number of tubers in each category x the category value}}{\text{Total number of tubers x maximum category value}}$$

Effect of seed treatment fungicides on storage diseases of potato were evaluated on progeny tubers that were stored for over 3.5 months following harvest (9-10 February, 2000). Fifty progeny tubers from each replicate were washed with water and rated for the incidence (percent area covered with disease lesions) of silver scurf *(H. solani)*, dry rot (*Fusarium* spp.) and common scab (*S. scabies*). Statistical analyses of the data were conducted using Genstat 5.0 (Lawes Agricultural Trust, Rothamsted Experimental Station, UK).

RESULTS: As outlined in Table 1.

CONCLUSIONS: With the exception of uninoculated check, a moderate (3.1-7.2%) Rhizoctonia stem canker was observed in all the fungicide treatments and the untreated check. A low stolon canker was observed in all the treatments and untreated checks. The presence of moderate black scurf (9.3%) in MAXIM 0.5% PSPT treated plots, which was significantly lower than the two untreated checks (untreated check and inoculated untreated check had 35.5 and 63.1%, respectively), shows that the MAXIM 0.5% PSPT reduced black scurf. In addition, MAXIM 0.5% PSPT treated plot had moderate black scurf compared to all other fungicide treated plots, which had severe (>10.0%) black scurf. A comparison of stem canker and black scurf incidence, in the present study, showed no direct relationship between the two stages of the disease. MAXIM 0.5% PSPT, also, significantly reduced silver scurf (4.9%) compared to the untreated check (7.5%). Because of the low incidence of dry rot (1.3 to 1.9 %) and common scab (0.9 to 1.1%) in all the fungicide treated plots and in untreated checks, effectiveness of the fungicides on dry rot and common scab could not be assessed. Inoculated untreated check, which showed slow emergence, and fewer number of stems/plant (data not shown) than all other treatments, gave yields similar to the eight treatments. The untreated check, and the fungicides had no significant effect on the marketable yield.

Table 1. Effect of seed piece treatment fungicides on the incidence of black scurf, silver scurf , dry rot and common scab of potato.

Treatment	Rate of product (ai)g/ kg seed	Stem canker[a]	Stolon canker[b]	Disease incidence[c]				Market -able yield (t/ha)[f]
				at harvest[d]		after storage[e]		
				Black scurf[g]	Common scab[h]	Dry rot[i]	Silver scurf[j]	
Untreated check	-----	8.1	1.3	35.5	1.0	1.8	7.5	35.9
Inoculated untreated check	-----	18.3	1.2	63.1	1.0	1.9	7.7	29.8
MAXIM® 0.33% PSPT	0.0166	4.3	1.3	16.0	1.0	1.6	5.8	35.9
MAXIM® 0.5% PSPT	0.025	5.2	1.1	9.3	1.0	1.7	4.9	34.9
MAXIM® MZ (Canadian formulation)	0.025	3.1	1.0	11.5	1.0	1.6	4.4	36.4
MAXIM®MZ (U.S.A. formulation)	0.025	4.2	1.1	15.1	1.0	1.5	6.6	33.2
DIVIDEND/MAXIM® 1.0% PSPT	0.025 + 0.025	5.8	1.1	16.6	0.9	1.3	4.9	35.4
DIVIDEND	0.025	4.2	1.3	51.0	1.1	1.5	5.2	36.2
EASOUT 10% PSPT	0.50	4.6	1.1	16.2	1.1	1.5	5.5	32.1
TUBERSEAL 12% PSPT		7.2	1.1	33.3	1.11	1.6	5.8	30.7
LSD for comparing means (P 0.05)		0.5	0.4	13.2	0.07	0.3	0.7	7.0
ANOVA (MAXIM vs Untreated) P 0.05		ns	ns	s	ns	ns	s	ns

[a] Percent area of stem covered with Rhizoctonia.stem canker.

[b] Percent area of stolon covered with Rhizoctonia stem canker.

[c] Values are means of four replications/treatment, 50 tubers/replication were rated for each of the diseases.

[d] Tubers were rated for black scurf and common scab on 16 November, 1999.

[e] Tubers were rated for storage diseases between 15-18 February, 2000.

[f] Canada No. 1 Marketable yield (55 - 85 mm).

[g] Black scurf lesion area index on tubers (LSI, see Methods).

[h] Percent tuber area covered with common scab.

[i] Percent tuber area covered with dry rot.

[j] Percent tuber area covered with silver scurf.

2000 PMR Report # 115 **SECTION M: POTATOES - Diseases.**
STUDY DATA BASE: 303-1251-9601

CROP: Potato (*Solanum tuberosum* L.) cv. Yukon Gold
PEST: Silver scurf (*Helminthosporium solani* Dur. and Mont.)
Black scurf (*Rhizoctonia solani* Kühn)

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TITLE: EVALUATION OF SEED PIECE TREATMENT, DITHANE M-45 DUST, FOR CONTROL OF SILVER SCURF (*HELMINTHOSPORIUM SOLANI*) ON POTATO IN PEI, 1999-2000.

MATERIALS: DITHANE M-45 (24%; Rohm and Haas).

METHODS: Seed pieces of potato cv. Yukon Gold, were treated with DITHANE M-45 in a plastic bag for a minimum of 2 minutes, and planted at the Crops and Livestock Research Centre's Research Farm in Harrington, PEI. The treatment of seed tubers with 5.0% silver scurf was designated as 'DITHANE M-45 A,' and the treatment of seed tubers with 35.0% silver scurf was designated as 'DITHANE M-45 B.' Seed was planted within two hours of the fungicide treatment. Two checks, 'untreated check A' (5.0% silver scurf) and 'untreated check B' (with no visible silver scurf symptoms), did not receive the fungicide. The trial was planted on 18 May, 1999 in rows 0.90 m apart with seed spacing of 0.30 m. Plots were 3.6 m long and 3 rows wide for a total of 36 seed pieces per plot. Each treatment was replicated 4 times in a randomized complete block design. Fertilizers, herbicides and insecticides were applied as and when required, at standard recommended rates (Publ. 1300A, Potato crop: variety, weed and pest control guide 1999 for the Atlantic Provinces). For late blight control, foliar applications of DITHANE M-45 at a rate of 1 kg in 40 gallon water/acre were made at weekly intervals starting from 03 July, 1999 and ending on 10 Sept. 1999. Plant emergence counts were taken on 31 May 1999, and stem counts were made on 19 June 1999. Potatoes were harvested on 14 September, 1999 and yields were recorded. Thirty to 50 potatoes from each of the treatment were rated for silver scurf and black scurf soon after harvest and also after 4.7 months in storage at 4 C and 95% relative humidity. Statistical analyses of the data were conducted using Genstat 5.0 (Lawes Agricultural Trust, Rothamsted Experimental Station, UK).

RESULTS: As outlined in Table 1.

CONCLUSIONS: In this study, DITHANE M-45 24% treatment reduced silver scurf in progeny of seed tubers with moderate (5.0%) and high (35.0%) silver scurf disease. Although, silver scurf was reduced to 13.4% incidence on the progeny tubers in the treatment, 'DITHANE M-45 24% B,' from 35.0% silver scurf incidence on the seed tubers at planting, the incidence was higher than the check, 'untreated check A' (11.7%). Also, in 'untreated check B' treatment, 9.7% silver scurf was observed on progeny tubers from the seed tubers with no visible symptoms. Low rhizoctonia black scurf incidence (ranged from 1.5 to 2.5%) was observed in all treatments in 1999. In conclusion, DITHANE M-45 24% provided most effective control of silver scurf on seed with 5.0% silver scurf infection, and had no significant effect on yield.

Table 1. Effect of DITHANE M-45 on black scurf and silver scurf at harvest and four months after storage, and on marketable yield.

Treatment	Rate (g ai/100 kg seed)	% Tuber area covered with Silver scurf[a]			Rhizoctonia RSI[bc]	Marketable yield (t/ha)[d]
		on seed at planting	4 Nov 1999	23 Feb 2000	23 Feb 2000	4 Nov 1999
Untreated check A	-----	5.0	0	11.7b[e]	1.6a	22.9a
Untreated check B	-----	0	0	9.7a	1.2a	22.5a
DITHANE M-45 24 % A	1.0	5.0	0	8.8a	1.2a	20.4a
DITHANE M-45 24 % B	1.0	35.0	0	13.4b	2.5b	22.3a

[a] Values are mean of 4 replications per treatment

[b] RSI = *Rhizoctonia solani* disease index. RSI is based on % tuber area covered by sclerotia x sclerotial severity.

[c] RSI at planting is < 5.0.

[d] Canada No.1 Marketable yield (55-85 mm).

[e] Means in a column followed by the same letter did not differ based on LSD at P 0.05.

CROP: Potato (*Solanum tuberosum* L.) cv. Russet Burbank
PEST: Black scurf (*Rhizoctonia solani* Kühn)
Silver scurf (*Helminthosporium solani* Dur. and Mont.)
Dry rot (*Fusarium* spp.)

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TITLE: EFFECT OF COMBINATIONS OF A FOLIAR FUNGICIDE (BRAVO) WITH AN INSECTICIDE (ADMIRE) AND/OR HERBICIDE (SENCOR) ON DISEASES CAUSED BY DIFFERENT SOILBORNE PATHOGENS OF POTATO, 1998 and 1999.

MATERIALS: Fungicide, BRAVO 500 (chlorothalonil); insecticide ADMIRE 240F (imidacloprid); and herbicide SENCOR 75DF (metribuzin). The rate of application for each of the agrichemicals is presented in Table 1.

METHODS: A trial was conducted at the Crops and Livestock Research Centre's Research Farm in Harrington, PEI in 1998 and 1999 to determine effect of combinations of a foliar late blight fungicide with an insecticide and herbicide on black scurf, dry rot and silver scurf of potato. Small whole seed tubers of potato cv. Russet Burbank were planted in rows 0.90 m apart with seed spacing of 0.40m. Each of the plots were 4.8 m long and 4 rows wide, the middle two rows received treatments while out side rows were used as guards. Four treatments were included in the experiment: 1) BRAVO (check); 2) BRAVO + ADMIRE; 3) BRAVO + SENCOR; and 4) BRAVO + ADMIRE + SENCOR. Each treatment was replicated 4 times in a randomized complete block design. Seed was planted on 12 May, 1998 and 7 May 1999. Fertilizer was applied as and when required, at standard recommended rates (Publ. 1300A, Potato crop: variety, weed and pest control guide 1998 for the Atlantic Provinces). Except when BRAVO was applied in combination with either an insecticide and/or herbicide, BRAVO was sprayed on the plots as and when required, at standard recommended rates (Publ. 1300A, Potato crop: variety, weed and pest control guide 1998 for the Atlantic Provinces). BRAVO + SENCOR was applied to treatments 3 and 4 on 28 May, 1998 and 15 June, 1999. BRAVO + ADMIRE was applied to treatments 2 and 4 on 30 June, 1998 and on 25 June, 16 July and 13 August in 1999. On August 28, 1998, an insecticide, FIPRONYL (aryl heterocycle) at a rate of 25 ml ai/ha was applied to treatments 2 and 4. Because of the high Colorado potato beetle infestation on potato plants in 1999, two extra sprays of BRAVO + ADMIRE were administered for the control of the insects. Potatoes were harvested on 8 October, 1998 and 29 September, 1999 and yields were recorded.

In both 1998 and 1999, disease assessment on potato tubers was carried out soon after harvest and after 3 months (1998) or 4 months(1999) in storage. Fifty progeny tubers from each replicate were washed with water and rated for the incidence (percent area covered with disease lesions) of silver scurf *(H. solani)*, dry rot (*Fusarium* spp.) and black scurf (*R. solani*). Statistical analyses of the data were conducted using Genstat 5.0 (Lawes Agricultural Trust, Rothamsted Experimental Station, UK).

RESULTS: As outlined in Table 1.

CONCLUSIONS: In 1998, all three treatments, BRAVO + SENCOR, BRAVO + ADMIRE, and BRAVO +ADMIRE + SENCOR had higher black scurf than the BRAVO (check). In 1999, there was no significant difference between the treatments and the check. The incidence of black scurf, 9.6% and 8.3%, respectively, in 1998 and 1999 suggests that the fungicide BRAVO, which is used for control of late blight fungus, did not reduce black scurf below the moderate levels (5-10%). A higher black scurf incidence in 1998 (ranged between 9.6 to 14.9%) than in 1999 (ranged between 8.2 to 8.9%), suggests that black scurf disease development may be dependent on the rhizoctonia inoculum present in the field or on tubers and the environmental conditions. Low levels (< 2.0%) of silver scurf and dry rot were observed in both 1998 and 1999 (data not shown) and the combinations of fungicide with an insecticide and/or herbicide had no effect on the storage diseases. In 1998, the combinations of fungicide with an insecticide and/or herbicide has no significant effect on marketable yield. In 1999, however, BRAVO (check) and the BRAVO + SENCOR had significantly lower yields than BRAVO +ADMIRE, and BRAVO +ADMIRE + SENCOR. Lower yields in 1999 may have resulted from dry growing season and severe Colorado potato beetle pressure on plants.

Table1. Effect of a combination of a foliar fungicide (BRAVO) with an insecticide (ADMIRE) and/or herbicide (SENCOR) on the incidence of black scurf at harvest.

Treatment	Rate of product (ai)g/ ha	1998		1999	
		Black scurf[a]	Marketable Yield (t/ha)[b]	Black scurf[a]	Marketable Yield (t/ha)[b]
BRAVO 500 (check)	1250	9.6	36.2	8.4	33.2
BRAVO 500 + ADMIRE 240F	1250+48	13.8	34.9	8.2	43.3
BRAVO 500 + SENCOR 75DF	1250+500	14.9	32.1	8.9	34.5
BRAVO 500 + ADMIRE 240F+ SENCOR 75DF	1250+48+ 500	11.9	36.3	8.6	43.2
LSD for comparing means (P=0.05)		1.7	6.9	1.3	8.5
ANOVA for Treatment P 0.05		s	ns	ns	s

[a] Values are means of four replications, 50 tubers/replication were rated for the disease.

[b] Canada No. 1 marketable yield (55-85 mm).

2000 PMR Report # 117 **SECTION M: POTATOES - Diseases**
STUDY DATA BASE: 303-1251-9601

CROP: Potato (*Solanum tuberosum* L.) cv. Kennebec
PEST: Black scurf (*Rhizoctonia solani* Kühn)
Silver scurf (*Helminthosporium solani* Dur. and Mont.)
Dry rot (*Fusarium* spp.)

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TITLE: EVALUATION OF SEED PIECE TREATMENT, PUROGENE, FOR CONTROL OF BLACK SCURF (*RHIZOCTONIA SOLANI*) ON POTATO IN PEI, 1999-2000.

MATERIALS: PUROGENE (200 ppm Chlorine dioxide) and EASOUT (thiophanate methyl 10% PSPT.

METHODS: A trial was conducted at the Crops and Livestock Research Centre's Research Farm in Harrington, PEI, on potato cv. Kennebec. Treatments were: 1) PUROGENE A; 2) EASOUT A; 3) PUROGENE + EASOUT A; 4) PUROGENE B; 5) EASOUT B; 6) PUROGENE + EASOUT B. Seed tubers with 5.0% black scurf were used in treatments 1 to 3 and seed tubers with 10.0% black scurf were used in treatments 4 to 6. Seed tuber pieces of potato were dip treated with PUROGENE for a minimum of 3 minutes, and air dried. Seed tuber pieces, including the ones that were treated with PUROGENE, were treated with EASOUT in a plastic bag for a minimum of 2 minutes. Two checks, 'untreated check A' with 5.0% black scurf and 'untreated check B' with with 10.0% black scurf symptoms on seed tuber surface, did not receive any fungicides. Fungicide treated seed tuber pieces and the checks (without the fungicide treatment), were planted within the two hours of the treatment. The trial was planted on 18 May, 1999 in rows 0.90 m apart with seed spacing of 0.30 m. Plots were 3.6 m long and 3 rows wide for a total of 36 seed pieces per plot. Each treatment was replicated 4 times in a randomized complete block design. Fertilizers, late blight fungicides, herbicides and insecticides were applied as and when required, at standard recommended rates (Publ. 1300A, Potato crop: variety, weed and pest untreated check guide 1999 for the Atlantic Provinces). Plant emergence counts were taken on 31 May 1999, and stem counts were made on 19 June 1999. Potatoes were harvested on 18 October, 1999 and yields were recorded. Fifty potatoes from each of the treatment were rated for black scurf, silver scurf and dry rot soon after harvest (20 October, 1999) and also after 3.6 months in storage (10 February, 2000). Statistical analyses of the data were conducted using Genstat 5.0 (Lawes Agricultural Trust, Rothamsted Experimental Station, UK).

RESULTS: As outlined in Table 1.

CONCLUSIONS: Similar emergence in treatments and checks showed that the treatments were not phytotoxic. In this study, either PUROGENE alone or EASOUT alone were not effective against black scurf, but PUROGENE + EASOUT treatment significantly reduced black scurf in the progeny of seed tubers with moderate (5.0%) and high (10.0%) black scurf disease. The effectiveness of the combination treatment on rhizoctonia disease complex indicates that under field conditions, the PUROGENE treatment is a relatively effective biocide, but not an eradicant of *R. solani*. While the PUROGENE + EASOUT had no effect on silver scurf on progeny from the seed tubers with moderate black scurf, the treatment significantly reduced silver scurf in progeny that was obtained from the seed tubers with high black scurf. Low dry rot incidence (ranged from 1.5 to 2.3%) was observed in all treatments in 1999 and the treatments had no effect on dry rot. Significantly higher yields were obtained in the plots treated with PUROGENE + EASOUT in the seed tubers with 5% infection, while the fungicide treatment had no effect on yield on the progeny from the seed tubers with 10.0% infection. In conclusion, combination treatment of PUROGENE + EASOUT provided most effective control of black scurf on progeny tubers from the seed tubers with 5.0% and 10.0% black scurf infection.

Table 1. Effect of PUROGENE on black scurf, silver scurf and dry rot, and on marketable yield.

Treatment	Rate of product	% Tuber area covered with[ab]			Marketable yield (t/ha)[e]
		Black scurf[c]	Silver scurf[d]	Dry rot[d]	
Seed tubers with 5% black scurf					
Untreated check A	---	6.9	9.6	2.2	24.1
PUROGENE A	200 ppm	6.5	14.1	2.3	20.7
EASOUT A	0.50 g ai/kg	4.9	5.2	1.5	24.9
PUROGENE +EASOUT A	200 ppm/0.50 g ai/kg	1.2	9.9	2.1	30.3
Seed tubers with 10% black scurf					
Untreated check B	---	5.3	15.1	1.8	25.9
PUROGENE B	200 ppm	5.9	14.5	2.3	20.7
EASOUT B	0.50 g ai/kg	6.5	5.5	1.5	24.9
PUROGENE +EASOUT B	200 ppm/0.50 g ai/kg	1.6	9.1	2.4	28.2
LSD for comparing means (P 0.05)		2.0	1.6	0.6	3.4

[a] Mean of 4 replications per treatment

[b] 50 tubers/replication were rated for each of the diseases.

[c] Incidence of black scurf at harvest.

[d] Incidence of silver scurf and dry rot after 3.6 months storage.

[e] Canada No.1 marketable yield (55-85 mm).

END OF SECTION M
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SECTION N:	**CEREAL, FORAGE AND OILSEED CROPS /CÉRÉALES, CULTURES FOURRAGÈRES ET OLÉAGINEUX**
REPORT /RAPPORT #:	**118 - 129**
PAGES:	**295 - 326**
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2000 PMR REPORT # 118 **SECTION N: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE #385-1212-9810

CROP: Barley, cv. AC Harper, AC Lacombe, CDC Earl
PEST: Scald (*Rhynchosporium secalis*)
Net blotch (*Pyrenophora teres*)

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TITLE: EFFECT OF TILT ON BARLEY LEAF DISEASES AND SILAGE PRODUCTION, 2000

MATERIALS: TILT (propiconazole 25%)

METHODS: The barley cultivars AC Harper, AC Lacombe and CDC Earl were seeded (220 seeds/m^2) into 4 row plots 5.5 m long with 23 cm row spacing on May 26, 2000. Two 23 cm rows of wheat were seeded between plots to limit disease spread. A randomized complete block design with 4 replications was used. TILT was applied at a rate of 500 mL/ha at either stem elongation (GS 31-32) or stem elongation and flag leaf emergence (GS 37). An untreated check was included for each cultivar. On August 2, 20 flag and 20 flag-1 leaves were collected from each plot and rated for the % leaf area diseased (PLAD) for scald (*Rhynchosporium secalis*), net blotch (*Pyrenophora teres*) and other leaf spots (mainly spot blotch, *Cochliobolus sativus*). At soft dough (GS 85) plots were harvested with a flail mower, sub-samples were air dried and wet and dry yields were calculated.

RESULTS: The results are presented in Table 1. TILT applied to AC Lacombe and CDC Earl at either GS 32 or GS 32 and 37 significantly reduced the amount of scald over the untreated on both the flag and flag-1 leaves, with the least PLAD recorded for the double application. AC Harper had lower scald incidence and did not show any significant differences for TILT application for either leaf. Net blotch levels were low in this experiment. TILT application on AC Lacombe significantly reduced net blotch PLAD on both leaves, but had no effect on AC Harper or CDC Earl. TILT application did not result in any significant differences for other leaf diseases present on the flag-1 for any cultivar. The only differences recorded for the other diseases on the flag leaf were for TILT applied at GS 32 on AC Lacombe. The application of TILT at GS 32 + 37 significantly increased wet silage yields over the untreated for each cultivar and dry silage yields were increased for AC Harper and CDC Earl only.

CONCLUSIONS: While TILT has mainly been used for controlling leaf diseases in grain crops, there may be some merit in using TILT to reduce leaf diseases and increase silage production when seeding certain barley cultivars. Careful choice of resistant cultivar will be a more important strategy and would eliminate the need for fungicide application in a silage production system.

Table 1. Effect of TILT on leaf diseases and silage production of 3 barley cultivars.

		Flag			Flag-1		
	TILT	Scald	Net	Other	Scald	Net	Other
Cultivar	GS[1]	PLAD	PLAD	PLAD	PLAD	PLAD	PLAD
AC Harper	32 + 37	0.5 e[2]	0.1 b	0.8 a	0.2 d	0.2 c	1.9 a
	32	0.5 e	0.2 b	0.7 abc	1.2 d	1.2 b	2.1 a
	None	1.2 de	0.1 b	0.7 abc	4.0 d	0.6 bc	1.7 a
AC Lacombe	32 + 37	0.6 e	0.2 b	0.4 de	0.8 d	0.7 bc	0.6 b
	32	2.0 de	0.2 b	0.3 e	15.0 c	1.3 b	1.0 b
	None	8.8 b	0.9 a	0.6 abcd	28.9 b	4.5 a	0.9 b
CDC Earl	32 + 37	3.9 cd	0.1 b	0.50 cde	4.4 d	0.2 c	0.8 b
	32	5.8 c	0.5 ab	0.7 ab	25.3 b	0.2 c	0.8 b
	None	32.0 a	0.1 b	0.52 bcde	55.5 a	0.1 c	0.7 b

Cultivar	TILT GS[1]	Wet Silage T/ha	Dry Silage T/ha
AC Harper	32 + 37	14.4 a	4.7 a
	32	13.6 ab	4.7 ab
	None	12.2 bc	4.2 bc
AC Lacombe	32 + 37	14.2 a	4.9 a
	32	12.9 abc	4.6 ab
	None	12.1 bc	4.4 ab
CDC Earl	32 + 37	11.7 c	3.8 c
	32	9.0 d	3.2 d
	None	8.2 d	2.9 d

[1] GS = growth stage.

[2] Numbers in a column followed by the same letter are not significantly different at P=0.05 (LSD).

2000 PMR REPORT # 119 **SECTION N: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**

ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cv. OAC Springfield
PEST: Blackleg (*Leptosphaeria maculans* (Desm.) Ces. et de Not.)

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TITLE: FIELD EVALUATION OF MAXIM 480FS, DIVIDEND 360FS AND VITAVAX RS AS SEED TREATMENTS TO CONTROL BLACKLEG OF CANOLA

MATERIALS: MAXIM 480FS (fludioxonil 480 g ai/L), DIVIDEND 360FS (difenoconazole 360 g ai/L), VITAVAX RS (carbathiin 33 g ai/L, thiram 66 g ai/L, lindane 500 g ai/L).

METHODS: Two trials of identical design were conducted at the Arkell Research Station, University of Guelph, in 1996. The design was a randomized complete block with 8 treatments and 5 replications. Each plot consisted of a treatment row 5 m long bordered on each side by a single guard row 7 m long. Rows were 40 cm apart. The guard rows were sown with untreated seed in unbroken strips across 5 contiguous blocks. Each treatment row was sown with treated seed and was separated from the treatment row in the adjacent block by 2 m of tilled soil. All treated seed was initially surface sterilized (0.6% sodium hypochlorite, 1 minute). Infested seed was prepared by soaking 4 g of seed in 10 mL of a conidial suspension of a highly virulent isolate of *L. maculans* (10^7 conidia/mL). Test products applied to the air-dried infested seed were MAXIM 480FS at 5.2 and 10.4 mL/100 kg to give 2.5 and 5.0 g ai/100 kg, DIVIDEND 360FS at 33.3 and 66.7 mL/100 kg to give 12 and 24 g ai/100 kg, MAXIM 480FS at 2.5 g ai/100 kg plus DIVIDEND 360FS at 12 g ai/100 kg, and VITAVAX RS at 3062 mL/100 kg to give 101 g ai carbathiin/100 kg, 202 g ai thiram/100 kg and 1531 g ai lindane/100 kg. Check treatments consisted of infested and uninfested seed not treated with product. Seed was sown 23 May at the rate of 20 seeds/m. COUNTER 5G (terbufos) was applied in the seed furrow at 6 kg/ha. CYMBUSH 250 EC (cypermethrin) was applied as needed as a postemergence spray to control insects (140 mL/ha). Emerged plants were counted 11 June and plant stand at harvest was counted 16-18 September. At harvest, all the plants in the treatment row were evaluated for disease incidence (percentage of plants with symptoms of blackleg) at the crown and for severity on a cross section of the crown on a scale of 0-4, where 0 is healthy, 1 is >0-25%, 2 is 26-50%, 3 is 51-75%, and 4 is 76-100% of the crown cross section discoloured.

RESULTS: Data are presented in Tables 1 and 2.

CONCLUSIONS: Infesting seed did not alter emergence or stand. VITAVAX in both trials and the high rate of DIVIDEND in trial 1 increased emergence from infested seed. Stand from infested seed was improved by VITAVAX in both trials, and by all other products, except the low rate of DIVIDEND, in one trial. The background incidence of blackleg (64-69%), presumably caused by airborne inoculum, was reduced only by VITAVAX in trial 1. Infestation of seed increased the incidence of blackleg in trial 1 and its severity in both trials. All products applied to infested seed reduced the incidence and severity of blackleg in trial 1. When applied to infested seed in trial 2, the high rate of DIVIDEND alone reduced blackleg incidence but all products except the low rate of MAXIM alone or in combination with the low rate of DIVIDEND reduced disease severity. Thus VITAVAX showed efficacy against airborne inoculum and all products showed efficacy against seedborne inoculum.

Table 1. Effect of seed treatments on blackleg of canola. Trial 1, 1996.

Treatment	Rate of product	Emergence[1]	Stand[2]	Blackleg incidence (%)	Blackleg severity[3]
Untreated, uninfested seed		27.6c[4]	26.2bc	64.2b	0.8d
Untreated, infested seed		33.2bc	24.4c	82.8a	1.9a
MAXIM 480FS	2.5 g ai/100 kg	34.2c	28.8bc	66.0b	1.4b
MAXIM 480FS	5.0 g ai/100 kg	37.2b	33.4b	62.4b	1.2bc
DIVIDEND 360FS	12 g ai/100 kg	34.8bc	30.6bc	56.6bc	1.0cd
DIVIDEND 360FS	24 g ai/100 kg	32.6bc	28.2bc	61.1b	1.0cd
MAXIM 480FS DIVIDEND 360FS	2.5 g ai/100 kg 12.0 g ai/100 kg	33.6bc	29.0bc	69.4b	1.5b
VITAVAX RS	1834 g ai/100 kg	53.8a	46.4a	44.9c	0.8d

[1] Plants/5 m of row 11 June.

[2] Plants/5 m of row 16-18 September.

[3] Based on a 0 (low)-4 (severe) scale

[4] Within a column, means followed by the same letter are not significantly different at $P = 0.05$ (PLSD).

Table 2. Effect of seed treatments on blackleg of canola. Trial 2, 1996.

Treatment	Rate of product	Emergence[1]	Stand[2]	Blackleg incidence (%)	Blackleg severity[3]
Untreated, uninfested seed		28.2c[4]	24.2cd	68.7ab	1.3b
Untreated, infested seed		27.4c	17.2d	82.2a	2.1a
MAXIM 480FS	2.5 g ai/100 kg	35.2bc	29.2abc	80.6a	1.8ab
MAXIM 480FS	5.0 g ai/100 kg	29.0c	24.0cd	70.5ab	1.5b
DIVIDEND 360FS	12 g ai/100 kg	31.8bc	27.6bcd	76.8ab	1.5b
DIVIDEND 360FS	24 g ai/100 kg	40.8ab	38.0ab	65.7b	1.3b
MAXIM 480FS DIVIDEND 360FS	2.5 g ai/100 kg 12.0 g ai/100 kg	34.8bc	29.4abc	71.6ab	1.6ab
VITAVAX RS	1834 g ai/100 kg	47.0a	39.2a	74.9ab	1.4b

[1] Plants/5 m of row 11 June.

[2] Plants/5 m of row 16-18 September.

3 Based on a 0 (low)-4 (severe) scale.

[4] Within a column, means followed by the same letter are not significantly different at $P = 0.05$ (PLSD).

2000 PMR REPORT # 120 **SECTION N: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cv. OAC Springfield
PEST: Blackleg (*Leptosphaeria maculans* (Desm.) Ces. et de Not.)

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TITLE: FIELD EVALUATION OF HELIX FORMULATIONS AND VITAVAX RS AS SEED TREATMENTS TO CONTROL BLACKLEG OF CANOLA

MATERIALS: MAXIM 480FS (fludioxonil 480 g ai/L), DIVIDEND 360FS (difenoconazole 360 g ai/L), APRON XL (metalaxyl-m 32.3%), MF1846 (confidential insecticide), VITAVAX RS (carbathiin 33 g ai/L, thiram 66 g ai/L, lindane 500 g ai/L).

METHODS: Two trials of identical design were conducted at the Arkell Research Station, University of Guelph, in 1997. The design was a randomized complete block with 5 treatments and 5 replications. Each plot consisted of a treatment row 5 m long bordered on each side by a single guard row 7 m long. Rows were 40 cm apart. The guard rows were sown with untreated seed in unbroken strips across 5 contiguous blocks. Each treatment row was sown with treated seed and was separated from the treatment row in the adjacent block by 2 m of tilled soil. All treated seed was initially surface sterilized (0.6% sodium hypochlorite, 1 minute). Infested seed was prepared by soaking 4 g of seed in 10 mL of a conidial suspension of a highly virulent isolate of *L. maculans* (10^7 conidia/mL). Formulated test products applied to the air-dried infested seed were "HELIX 1" (MAXIM 480FS + APRON XL + MF1846) at 2 L/100 kg seed to give 2.5 g + 7.5 g + 400 g ai/100 kg seed, "HELIX 2" (MAXIM 480FS + APRON XL + DIVIDEND 360FS + MF1846) at 2 L/100 kg seed to give 2.5 g + 7.5 g + 24 g + 400 g ai/100 kg seed, and VITAVAX RS at 2.25 L/100 kg seed to give 101 g ai carbathiin + 202 g ai thiram + 1531 g ai lindane/100 kg seed. Check treatments consisted of infested and uninfested seed not treated with product. Seed was sown 21 May at the rate of 20 seeds/m. CYMBUSH 250 EC (cypermethrin) was applied as needed as a postemergence spray to control insects (140 mL/ha). Emerged plants were counted 10 June and plant stand at harvest was counted 15-19 September. At harvest, all the plants in the treatment row were evaluated for disease incidence (percentage of plants with symptoms of blackleg) at the crown and for severity on a cross section of the crown on a scale of 0-4, where 0 is healthy, 1 is >0-25%, 2 is 26-50%, 3 is 51-75%, and 4 is 76-100% of the crown cross section discoloured.

RESULTS: Data are presented in Tables 1 and 2.

CONCLUSIONS: In the untreated checks, emergence and stand were low, and much of the crop was immature at harvest. Infesting seed did not alter emergence or stand. In all treated plots, emergence and stand were increased appreciably, and plants were mature at harvest. Thus, seed treatment led to normal stands with normal maturity under the stressful conditions of the test. Infesting seed did not increase incidence or severity of blackleg, therefore efficacy of the products against seedborne *L. maculans* could not be determined. This was unexpected since, in the laboratory, all infested seed germinated and 90% of infested seed produced colonies of the pathogen. Dry weather in July may have inhibited transmission of the pathogen from seed to the plant. Generally, the test products had no effect on blackleg incidence or severity, except that "HELIX 1" increased the severity of blackleg in trial 2. It is possible that the weak growth, sparse canopies and delayed maturation of plants from untreated seed suppressed development of blackleg.

Table 1. Effect of seed treatments on blackleg of canola. Trial 1, 1997.

Treatment	Rate of product	Emergence[1]	Stand[2]	Blackleg incidence (%)	Blackleg severity[3]
Untreated, uninfested seed		13.8c[4]	12.2b	25.7a	0.36a
Untreated, infested seed		22.8c	21.2b	22.7a	0.30a
MAXIM 480FS APRON XL MF1846 (HELIX 1)	2.5 g ai/100 kg 7.5 g ai/100 kg 400 g ai/100 kg	43.2ab	42.2a	23.1a	0.34a
MAXIM 480FS APRON XL DIVIDEND 360FS MF1846 (HELIX 2)	2.5 g ai/100 kg 7.5 g ai/100 kg 24 g ai/100 kg 400 g ai/100 kg	39.4b	39.2a	24.5a	0.32a
VITAVAX RS	1830g ai/100 kg	54.4a	49.8a	24.9a	0.36a

[1] Plants/5 m of row 10 June.

[2] Plants/5 m of row 15-19 September.

[3] Based on a 0 (low)-4 (severe) scale.

[4] Within a column, means followed by the same letter are not significantly different at $P = 0.05$ (PLSD).

Table 2. Effect of seed treatments on blackleg of canola. Trial 2, 1997.

Treatment	Rate of product	Emergence[1]	Stand[2]	Blackleg incidence (%)	Blackleg severity[3]
Untreated, uninfested seed		10.6b[4]	10.4b	22.0b	0.26b
Untreated, infested seed		21.6b	17.4b	24.3ab	0.34b
MAXIM 480FS APRON XL MF1846 (HELIX 1)	2.5 g ai/100 kg 7.5 g ai/100 kg 400 g ai/100 kg	61.0a	59.0a	41.0a	0.90a
MAXIM 480FS APRON XL DIVIDEND 360FS MF1846 (HELIX 2)	2.5 g ai/100 kg 7.5 g ai/100 kg 24 g ai/100 kg 400 g ai/100 kg	47.0a	45.2a	35.0ab	0.64ab
VITAVAX RS	1830g ai/100 kg	56.8a	53.4a	24.4ab	0.44b

[1] Plants/5 m of row 10 June.

[2] Plants/5 m of row 15-19 September.

[3] Based on a 0 (low)-4 (severe) scale.

[4] Within a column, means followed by the same letter are not significantly different at P = 0.05 (PLSD).

2000 PMR REPORT # 121 **SECTION N: CEREALS, FORAGE CROPS AND OILSEED - Diseases**
STUDY DATA BASE: 375-113-9613

CROP: Canola (*Brassica napus* L.), cvs. Westar, Invigor 2663
Field pea (*Pisum sativum* L.), cv. Highlight
Flax (*Linum usitatissimum* L.), cv. Norlin
Wheat (*Triticum aestivum* L.), cv. AC Barrie

PEST: Blackleg (*Leptosphaeria maculans* (Desm.) Ces and de Not) - canola
Sclerotinia stem rot (*Sclerotinia sclerotiorum* (Lib.) De Bary) - canola
Pasmo (Septoria linicola (Speg.) Garassini / *Mycosphaerella linicola*) - flax
Mycosphaerella blight (*Mycosphaerella pinodes* (Berk. & Blox.) Vestergr. / *Phoma medicaginis* Malbr. & Roum. var. *pinodella* (Jones) Boerema.) - peas
Septoria complex (*Septoria tritici* Rob. In Desm. and *S. nodorum* (Berk.) Berk.) - wheat
Tan spot (*Pyrenophora tritici-repentis* (Died.) Drechs) - wheat

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TITLE: EFFECT OF FUNGICIDES FOR DISEASE CONTROL IN SHORT ROTATIONS

MATERIALS: QUADRIS (azoxystrobin 250 g.ai./L SC), RONILAN (50% vinclozolin EG), TILT (propiconazole, 250 g. ai./L EC).

METHODS: This study was established at Scott (1998) and Melfort, SK (1999) under a zero-tillage management system. A split-plot design was used with rotation as main-plot, and fungicide treatments as the sub-plots. Rotations included: continuous pea and canola, canola-wheat, pea-wheat, pea-canola-wheat, pea-wheat-canola-wheat and flax-wheat-canola-wheat. Two cultivars of canola were used; an open-pollinated (Westar) and a herbicide tolerant hybrid (Invigor 2663). There were four replications with each phase of the rotations occurring every year. Each sub-plot was 7.6 x 15.2 m. Pea seed was inoculated with Soil Implant granulated peat at 5.6 kg/ha. All plots were seeded May 8 at Melfort and May 10-15 at Scott with a 3.7 m pneumatic plot seeder with fertilizer side-banded (2.5 cm to the side and 6.5 cm below the seed) at seeding.

QUADRIS at 125 g. ai./ha in 100L/ha of water was applied to canola at the 2-3 leaf stage in Melfort and 3-4 leaf stage at Scott; RONILAN was applied at 500 g. ai./ha in 100L/ha of water at 20 to 30% bloom. Pea was sprayed with QUADRIS at 175 g.ai./ha in 100L/ha of water at 10% bloom at Melfort and 30% at Scott. TILT was applied to wheat at 125 g.ai./ha in 200L/ha of water at flag leaf emergence at both locations. Flax received an application of QUADRIS at 125 g.ai./ha in 100L/ha of water at the end of flower for both sites. All fungicides at Melfort were applied with a 9.1 m single-arm boom with course low drift Venturi nozzles at 0.45m above the crop canopy. At Scott a three point hitch sprayer fitted with

cone guards were used for fungicide application.
Flax was assessed for pasmo twice, at the end of flowering and at onset of boll maturity using a 0-9 scale based on infection of leaf and stem tissue. Pea was assessed for mycosphaerella blight using a scale similar to flax at podding stage of crop development. Canola was assessed for blackleg and sclerotinia incidence (%) based on the number of infected plants in a sample of 200 evaluated just prior to swathing. Wheat was assessed for foliar disease on the Horsfall-Barrett scale and converted to percentage of leaf area diseased on 25 plants/plot at the soft dough stage of kernel development. Seed yield was recorded for each plot.

RESULTS: Disease assessments and yields of crops are presented in Tables 1 and 2. Means are pooled results of all rotations, 3rd year at Scott and 2nd year at Melfort.

CONCLUSIONS: Fungicides were effective for reduction of foliar disease symptoms in all crops except canola. The only crops not to respond to fungicide application with increased yield were flax and Invigor 2663 at Melfort and either canola cultivar at Scott. There was poor weed control in flax at Melfort which may explain the lower yield than at Scott and the greater variability as measured by the LSD test. If considered at P=0.10 flax at Melfort responded to QUADRIS by an increased yield of 21% and Scott by 10% (P=0.05). Pea showed the largest yield response to QUADRIS, with an increase of 21% at Melfort and 23% at Scott. Application of TILT increased wheat yields by 21% at Melfort and 12% at Scott. In canola blackleg incidence was reduced with QUADRIS application at Scott but sclerotinia stem rot incidence was unchanged by application of RONILAN. At Melfort there was no difference in blackleg incidence for either cultivar but Invigor 2663 did have a slight reduction in sclerotinia stem rot incidence. However Westar canola yield increased 19% at Melfort and 8% at Scott (P=0.10) with fungicide application. QUADRIS or RONILAN application did not increase yield of Invigor 2663 at either location.

Table 1. Effect of fungicide treatment on disease severity and yield of flax, wheat, canola and pea at Melfort, 2000.

	Flax		Wheat		Canola				Pea
					Westar		Invigor 2663		
	flower[a] (0-9)	boll[b] (0-9)	flag[c] (%)	penul[d] (%)	SCI[e] (%)	BLI (%)	SCI (%)	BLI (%)	(0-9)
Disease Rating									
Control	6.5	6.7	80.2	91.3	40.0	42.0	39.0	17.0	7.7
Fungicide	5.5	0.9	73.0	72.4	42.0	38.0	34.0	13.0	7.2
LSD$_{(0.05)}$	0.7	2.1	4.8	13.3	8.0	5.0	3.0	7.0	0.4
Yield (kg/ha)									
Control	1226		2944		1292		2318		1673
Fungicide	1483		3574		1535		2370		2026
LSD$_{(0.05)}$	294		74		181		117		170

[a] Disease assessment at end of flowering, infection confined to leaflets.
[b] Disease assessment at boll fully formed stage, infection most obvious on stems.
[c] % of diseases tissue on the flag leaf at soft dough stage.
[d] % of diseased tissue on the penultimate leaf at soft dough stage.
[e] Sclerotinia stem rot incidence at swathing, % of 200 plants infected.
[f] Blackleg incidence at swathing, % of 200 plants infected.

Table 2. Effect of fungicide treatment on disease severity and yield of flax, wheat, canola and pea at Scott, 2000.

	Flax		Wheat		Canola				Pea
					Westar		Invigor 2663		
	flower[a] (0-9)	boll[b] (0-9)	flag[c] (%)	penul[d] (%)	SCI[e] (%)	BLI[f] (%)	SCI (%)	BLI (%)	(0-9)
Disease Rating									
Control	7.4	-	93.5	97.5	1.3	61.0	0.6	12.8	7.5
Fungicide	6.3	-	87.4	96.3	1.0	47.0	0.8	8.2	6.8
$LSD_{(0.05)}$	0.6	-	4.3	1.0	0.6	6.0	0.4	3.0	0.3
Yield (kg/ha)									
Control	2194		3466		1428		2115		2496
Fungicide	2410		3880		1540		2099		3077
$LSD_{(0.05)}$	150		133		113		171		141

[a] Disease assessment at end of flowering, infection confined to leaflets.

[b] Disease assessment not conducted at boll fully formed stage.

[c] % of diseases tissue on the flag leaf at soft dough stage.

[d] % of diseased tissue on the penultimate leaf at soft dough stage.

[e] Sclerotinia stem rot incidence at swathing, % of 200 plants infected.

[f] Blackleg incidence at swathing, % of 200 plants infected.

2000 PMR REPORT # 122 **SECTION N: CEREAL, FORAGE AND OILSEED CROPS - Diseases**
ICAR: 61006537

CROP: Soybeans (*Phaseolus vulgaris* L.), cv. SW3308
PEST: Rhizoctonia root rot, *Rhizoctonia solani* Kühn

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TITLE: CONTROL OF SEEDLING DISEASE IN SOYBEANS WITH SEED TREATMENTS

MATERIALS: APRON MAXX (fludioxonil + metalaxyl, 96.5 + 144 g ai/L); APRON MAXX RTA (fludioxonil + metalaxyl-m, 19.05 g ai/L); APRON XL (metalaxyl-m, 369 g ai/L; MAXIM/APRON XL / DIVIDEND 96 FS (fludioxonil + metalaxyl-m + difenoconazole, 10.9 + 32.6 + 52.2 g ai/L); VITAFLO 280 (thiram + carbathiin, 130 + 150 g ai/L); LI022-A1; STILETTO (L0202-A1).

METHODS: Seed was treated in 1 kg lots in individual bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. In-furrow granular insecticides were applied using a Noble® applicator. Soybeans were planted on 17 May, 2000 at a seeding rate of 15 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 4 rows, 10 m in length and spaced 0.76 m, arranged in a RCBD with 4 replications. Emergence and vigor, were assessed using a scale of 1-10 (10 = best plant development and 1 = 10% of most advanced plant development), on 5, 16, 23 and 30 June, 2000 and 13 July, 2000. Ten plants from each check plot were randomly picked for determination of the incidence of disease. Plots were harvested on 31 October, 2000 and yield corrected to 14.5% moisture.

RESULTS: See Tables 1, 2 and 3.

CONCLUSIONS: There were no significant differences amongst treatments. There was high variability in this trial due to wet emergence conditions.

Table 1. Assessment for emergence and vigor at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/ kg seed	Emerg (#plants /10 m) 5-6-00	Emerg (#plants/ 10 m) 16-6-00	Vigor (1-10) 16-6-00	Emerg (#plants /10 m) 23-6-00	Vigor (1-10) 23-6-00	Emerg (#plants /10 m) 13-7-00	Vigor (1-10) 13-7-00
CHECK		89	90	3.5	94	5.3	90	7.8
APRON MAXX	0.26 ml	99	102	5.3	103	5.5	102	8.5
APRON MAXX RTA	3.28 ml	89	94	5.3	97	4.5	99	8.0
APRON MAXX RTA +APRON XL	3.28 ml + 0.027 ml	97	96	5.3	100	6	105	9
MAXIM/APRON XL/ DIVIDEND	2.3 ml	88	94	5.3	94	4.8	96	8
VITAFLO 280	2.6 ml	94	99	3.5	99	3.8	105	7.3
VITAFLO 280 +APRON	2.6 ml 0.16 ml	92	93	6	97	5.5	99	8.8
L1022-A1	3.10 ml	91	100	4.8	97	2	99	7.8
STILETTO	4.4 ml	100	105	6.3	108	7.8	107	8.3
LSD (P=.05)		NS	NS	NS	NS	NS	NS	NS
CV		14.4	12.1	59.2	11.4	51.6	9.5	18.4

Table 2. Yield for soybeans at Ridgetown, Ontario. 2000.

Treatment	Rate	Yield (kg/ha) 2-11-00
CHECK		750
APRON MAXX	0.26 ml	781
APRON MAXX RTA	3.28 ml	745
APRON MAXX RTA + APRON XL	3.28 ml + 0.027 ml	798
MAXIM/APRON XL/ DIVIDEND	2.3 ml	795
VITAFLO 280	2.6 ml	755
VITAFLO 280 +APRON	2.6 ml + 0.16 ml	769
L1022-A1	3.10 ml	749
STILETTO	4.4 ml	786
LSD		NS
CV		6.5

Table 3. Average incidence of disease organisms in 10 random plants from each check plot at Ridgetown, Ontario. 2000.

	% Fusarium sp	% Pythium	% Phytophthora	% Rhizoctonia solani
Soybean	100	7.5	5	25

2000 PRM REPORT # 123 **SECTION N: CEREAL, FORAGE, AND OILSEED CROPS - Diseases**
ICAR: 61006537

CROP: Soybeans (*Phaseolus vulgaris* L.), cv, SW3308, damping off.
PEST: Rhizoctonia root rot, *Rhizoctonia solani* Kühn

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TITLE: CONTROL OF RHIZOCTONIA DAMPING OFF IN SOYBEANS WITH SEED TREATMENTS

MATERIALS: APRON MAXX (fludioxonil + metalaxyl, 96.5 + 144 g ai/L); APRON MAXX RTA (fludioxonil + metalaxyl-m, 19.05 g ai/L); APRON XL (metalaxyl-m, 369 g ai/L; MAXIM/APRON XL/ DIVIDEND 96 FS (fludioxonil + metalaxyl-m + difenoconazole, 10.9 + 32.6 + 52.2 g ai/L); VITAFLO 280 (thiram + carbathiin, 130 + 150 g ai/L); LI022-A1; STILETTO (L0202-A1).

METHODS: Seed was treated in 1 kg lots in individual bags by applying the material via a syringe to each bag. The seed was then mixed for 1 minute to ensure thorough seed coverage. Soybeans were planted in two separate areas on 30 May and 15 June, 2000 respectively, at a seeding rate of 20 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were single rows spaced 0.76 m apart and 2 m in length and arranged in a RCBD with 4 replications. Two methods of artificial inoculation were used. The first planting was inoculated on 4 July, 2000 with *Rhizoctonia solani* inoculum prepared in a GOOP suspension (see below) and an overhead misting system was turned on. The second planting was inoculated with *Rhizoctonia solani* applied in-furrow using 50 g dry inoculum (see below) per row. In-furrow plots were irrigated for 1 week to keep the soil moist but not wet. Plant emergence and plot vigor ratings, using a scale of 1-10 (10= most advanced plant development and 1 = 10% development of most advanced plant) were taken on the in-furrow plots on 4 and 20 July, 2000 and a final plant stand was taken on 28 July, 2000. Root rot ratings using a scale of 0-6 (0: no symptoms, 1: <=25% taproot discolouration which is superficial, 2: >25% but <= 50% discolouration superficial, 3: > 50% but <= 75% discolouration superficial, 4: >75% but <= 100% discolouration superficial, 5: 100% discolouration but <= 50% discolouration is deep, 6: 100% discolouration but > 50% discolouration is deep) were taken on 10 plants in the GOOP-inoculated plots on 26 July and on 20 plants in the in-furrow inoculated plots on 9 August, and an average rating score per plot was calculated.

INOCULUM: *Rhizoctonia solani* inoculum was produced by weighing out 1 kg of hulless oats into each of several large pickle jars, covering oats with 2% V-8 juice and allowing mixture to sit for 1-2 hours. Excess liquid was then drained off, jar openings covered with tin foil under the lids, and jars autoclaved at 15 psi and 121° C for 30 min. Autoclaving was repeated 3 days later.
A strain of *Rhizoctonia solani* (86-8b) was obtained from AAFC- Harrow Research Centre and cultured onto Potato Dextrose Agar (PDA). The PDA plates of *R. solani* were cut up into small square plugs and 6-8 plugs were placed in each jar of sterile oats. The jars were incubated at room temperature for 2 weeks. After 2 days of incubation there were golf ball sized chunks of inoculum present. Every third day the jars were shaken to distribute the inoculum evenly. After 2 weeks of incubation, 300 g inoculum was blended with 5 L of distilled water and sodium alginate was added as a thickener to make a 6 %

GOOP suspension of inoculum. Ten ml syringes, with a large hole made in the end, were used to deliver 2 ml of the inoculum to each plant. Plants were inoculated with 1 ml of inoculum on each side of the stem at the soil line and misting was turned on. Irrigation was stopped after 10 days.

DRY INOCULUM: Inoculum was prepared in the same manner as above. After the 2 weeks incubation the inoculated oats were dried and weighed out into packages of 50 g each and applied in-furrow at planting.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: APRON MAXX RTA and MAXIM/APRON XL/DIVIDEND resulted in the highest emergence rate and seedling vigor, significantly higher than VITAFLO 280, VITAFLO 280 plus APRON, L1022-A1 and STILETTO. These two treatments result in >85% emergence compared with <25% in the inoculated controls. None of the materials provided protection against root rot evaluated under either method of inoculation.

Table 1. In-furrow inoculations of *Rhizoctonia solani*: Plant assessments at Ridgetown, Ontario. 2000.

Treatment	Rate g or ml/kg seed	Emerg #plants 2 m row 4-7-00	Vigor (1-10) 4-7-00	Emerg # plants 2 m row 20-7-00	Vigor (1-10) 20-7-00	Final Stand # plant 28-7-00	Root Rating (0-6) 9-8-00
CHECK		9.3 d[1]	2.0 c	9.0 c	3.0 c	8.8 c	3.63
APRON MAXX	0.26 ml	32.5ab	9.0 a	32.8 a	9.5 a	31.8 a	3.85
APRON MAXX RTA	3.28 ml	34.5 a	8.8 a	32.3 a	8.5 a	34.8 a	3.72
APRON MAXX RTA +APRON	3.28 ml 0.027 ml + 2.973 water	31.8ab	8.8 a	31.0 a	8.5 a	33.0 a	3.78
MAXIM/APRON XL/ DIVIDEND	2.3 ml	34.8 a	9.8 a	34.8 a	9.8 a	34.8 a	3.80
VITAFLO 280	2.6 ml	21.3 c	6.3 b	18.8 b	6.8 b	20.8 b	3.6
VITAFLO 280 +APRON	2.6 ml 0.16 ml + 2.84 water	26.0bc	6.3 b	23.0 b	6.8 b	22.3 b	3.88
L1022-A1	3.1 ml	23.3 c	6.0 b	23.0 b	6.8 b	22.0 b	3.7
STILLETO	4.4 ml	21.5 c	4.3 b	21.5 b	6.3 b	23.0 b	3.9
LSD (P=.05)		8.2	2	7.2	1.5	7.6	NS
CV		21.4	20.4	19.6	14.4	20.3	8.7

[1] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Basal seedling inoculation (GOOP): Root rot damage (*Rhizoctonia solani)* at Ridgetown, Ontario. 2000.

Treatment	Rate	Root Rot Ratings (Scale 0-6) 26-7-00
CHECK		3.5
APRON MAXX	0.26 ml	3.4
APRON MAXX RTA	3.28 ml	3.7
APRON MAXX RTA +APRON XL	3.28 ml 0.027 ml + 2.973 water	3.2
MAXIM/APRON XL/ DIVIDEND	2.3 ml	2.9
VITAFLO 280	2.6 ml	2.6
VITAFLO 280 + APRON	2.6 ml 0.16 ml + 2.84 water	3.2
L1022-A1	3.1 ml	3.5
STILETTO	4.4 ml	2.9
LSD (P=.05)		NS
CV		20.6

2000 PMR REPORT # 124 **SECTION N: CEREALS ,FORAGE CROPS AND OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Wheat, cv. Belvedere
PEST: Septoria leaf blotch, *Septoria nodorum*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF SEPTORIA LEAF BLOTCH AND ON YIELD OF SPRING WHEAT, 2000

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), BAYTAN 30 (triadimenol, 30%), RAXIL FL (tebuconazole, 1.5%), DIVIDEND XL RTA (difenoconazole 3.37%, metalaxyl-m 0.27%), CHARTER (triticonazole 2.5%)

METHODS: Wheat seed, cv. Belvedre, a powdery mildew tolerant cultivar, was treated using a small batch seed treater with the materials and at the rates listed in the table below. Plots were established on May 31, 2000, at a seeding rate of 350 viable seeds per m^2. Each plot was 10 rows wide and five metres long, 17.8 cm between rows. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were replicated four times in a randomized complete block design.

Emergence was taken on 2 x 1m of row prior to tillering. Septoria leaf blotch severity was rated on August 11, 2000, at ZGS 82, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine, August 30, 2000

RESULTS: Results are contained in Table 1.

CONCLUSIONS: Seed treatments had no significant impact on foliar disease severity. Only BAYTAN 30 had any effect on yield. While not rated fusarium head blight was a serious problem in the plots and was responsible for the relatively low yields in the plots. The reason for yield benefit from BAYTAN 30 treatment could not be definitely determined, but it would not appear to be as a result of foliar disease control.

Table 1. Efficacy of fungicide seed treatments in spring wheat, Charlottetown, PEI, 2000.

Treatment	Rate (ml product/kg seed)	Septoria leaf blotch (ZGS 82)[1]		Yield (kg/ha)	1000 Kwt (g)
		2nd leaf (%)	3rd leaf (%)		
Untreated Control	-	8.2	21.1	2190	23.70
VITAFLO 280	3.3	12.4	31.1	2042	24.05
BAYTAN 30	2.5	15.3	30.3	2195	23.10
BAYTAN 30	5.0	8.7	20.4	2511	25.10
RAXIL FL	2.5	15.2	34.4	1961	23.95
DIVIDEND XL RTA	3.25	9.1	25.8	2072	24.00
CHARTER	4.0	14.5	30.3	2244	24.75
CHARTER	6.0	13.9	31.0	2142	24.45
SEM	-	2.94	4.14	106.6	0.566
LSD (0.05)	-	ns[2]	ns	313.6	ns

[1] ZGS - Zadoks Growth Stage.

[2] (ns) - no significant difference, p=0.05.

2000 PMR REPORT # 125 **SECTION N: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**

CROP: Winter wheat (*Triticum aestivum* L.), cv. several
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: SUSCEPTIBILITY OF WINTER WHEAT VARIETIES TO FUSARIUM HEAD BLIGHT, AND CONTROL BY TEBUCONAZOLE (FOLICUR 432 F) IN ARTIFICIALLY INOCULATED, MISTED PLOTS. I.

MATERIALS: FOLICUR 432 F (432 g a.i./L tebuconazole)

METHODS: The crop was planted on October 20, 1999 at Ridgetown, Ontario using a 6-row cone seeder at 400 seeds/m^2. Plots were six rows planted at a row spacing of 17.8 cm and 4 m in length placed in a randomized block design with four replications. The plots were fertilized and maintained using provincial recommendations. Front half of each plot (2 m in length) was sprayed with FOLICUR 432 F (432 g a.i./L) when primary wheat heads were at 50% anthesis for each variety (Zadoks growth stage 60 to 69,) using a back pack precision sprayer with a 1-m boom fitted with 2 twin jet nozzles spaced at 50 cm delivering 240 L/ha of water. Each plot was inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml two days following treatment with fungicide. The suspension was produced in liquid shake culture using modified Bilay's medium. Plots were misted daily beginning after the first plots were inoculated. The mist system was engaged until three days after the last variety was inoculated. Each variety was assessed for visual symptoms when the early dough stage was reached. Primary wheat heads were selected at random out of each plot, and rated for disease incidence and severity using the scoring system developed by Stack and McMullen. Disease levels were calculated as fusarium head blight index (FHBI), which was the product of the percent heads infected and the percent spikelets infected /100. The plots were harvested on July 18, 2000 and the yields were corrected to 14 % moisture. Deoxynivalenol (DON) content was estimated with three replications using a quantitative ELISA test.

RESULTS: The results are given below.

CONCLUSIONS: Mean FHB indices (41.1 versus 45.7) and DON content (6.6 versus 9.4 ppm) across cultivars were significantly (paired t-test $P<0.01$) lower, and yield was significantly (paired t-test $P<0.01$) higher (4.5 versus 3.9 T/ha) when FOLICUR applications were made. Freedom (# 7) had the lowest, while AC DELTA (# 24) had the highest DON level with/without FOLICUR. AC ZORRO had the lowest FHB indices, but very high DON levels by comparison with other cultivars tested.

Table 1. Fusarium head blight reaction, DON content (ppm by ELISA), and yield (T/ha) of winter wheat cultivars in artificially inoculated and misted plots at Ridgetown, Ontario, 2000.

Cultivar	Severity (%)	Incidence (%)	FHBI (0-100)	% of FHB mean	FHB Rank	DON (ppm)	% of DON mean	DON Rank	Yield (T/ha)
HARUS	62.5	86.7	55.3	120.8	32	10.4	110.1	21	4.1
KARENA	59.2	86.7	52.5	114.7	26	12.9	136.9	28	3.0
AC RON	53.8	96.7	52.0	113.6	25	9.8	103.7	20	3.6
OAC ARISS	64.2	86.7	56.7	123.8	33	10.8	115.0	23	3.6
FUNDULEA	57.3	83.3	47.7	104.4	22	2.7	28.7	2	4.3
MARILEE	46.7	83.3	39.2	85.6	7	4.0	42.5	4	3.8
FREEDOM	51.7	80.0	41.3	90.3	11	2.1	22.3	1	4.1
AC CARTIER	48.7	80.0	39.0	85.2	5	5.8	61.6	13	3.2
AC MORLEY	52.5	83.3	44.0	96.1	17	4.8	51.0	11	3.8
25W33	49.7	86.7	41.7	91.2	13	11.4	120.7	26	4.4
HANOVER	59.2	83.3	49.8	108.7	24	4.7	50.2	10	3.5
MENDON	59.2	80.0	47.3	103.4	21	4.2	44.9	8	4.1
RC98109	49.8	80.0	39.9	87.1	8	11.2	119.2	25	4.6
PATRIOT	58.0	83.3	48.5	105.9	23	4.6	48.8	9	3.7
2540	47.5	76.7	36.0	78.7	3	9.5	101.2	19	4.8
FWB 728	63.7	83.3	53.1	116.0	27	6.9	72.9	16	3.7
CM96097	57.3	93.3	54.3	118.6	30	8.9	94.8	18	4.6
SUPERIOR	55.8	66.7	36.6	79.9	4	14.9	158.5	31	3.5
25R26	52.7	83.3	43.9	95.9	16	3.5	37.2	4	4.1
25W60	56.2	83.3	46.8	102.2	19	14.8	157.4	30	4.2
AC MACKINNON	52.2	80.0	41.7	91.2	14	10.4	110.4	22	4.0
AC MOUNTAIN	57.5	80.0	46.2	100.9	18	7.5	79.3	17	3.8
AC ESSEX	48.5	83.3	40.3	88.0	9	11.2	118.6	24	5.1
AC DELTA	59.3	90.0	54.0	118.1	28	34.7	368.4	35	1.5
ASHLAND	52.8	76.7	40.5	88.5	10	4.0	42.5	6	4.1
CM95009	46.8	83.3	39.1	85.4	6	6.5	69.3	15	5.3
CM951067	41.7	70.0	30.0	65.6	2	3.2	34.0	3	4.5
CALEDONIA	63.3	83.3	54.1	118.2	29	12.7	134.5	27	4.4
139J	66.2	83.3	55.0	120.1	31	4.0	41.8	7	4.2
TW95412	54.8	80.0	43.9	95.8	15	6.1	64.8	14	4.3
CM97001	50.8	80.0	41.4	90.5	12	12.9	136.9	29	2.4
CM546	67.7	86.7	58.8	128.5	34	5.1	53.8	12	4.8
TW96273	58.5	80.0	47.0	102.7	20	16.0	169.9	33	4.3
TW96/155	69.8	93.3	65.7	143.5	35	21.6	229.3	34	2.2
AC ZORRO	24.3	46.7	17.3	37.8	1	15.7	166.7	32	2.5
Mean	54.9	81.8	45.7	100.0		9.4	100.0		3.9
CV	22.4	11.8	29.1			38.9			16.2

Table 2. Fusarium head blight reaction, DON content (ppm by ELISA), and yield (T/ha) of winter wheat cultivars after FOLICUR application, in artificially inoculated and misted plots at Ridgetown, Ontario, 2000.

Cultivar	Severity (%)	Incidence (%)	FHBI (0-100)	% of FHB mean	FHB Rank	DON (ppm)	% of DON mean	DON Rank	Yield (T/ha)
HARUS	55.3	96.7	54.0	131.2	34	6.9	104.4	22	5.3
KARENA	44.3	76.7	34.2	83.2	4	6.7	100.9	21	4.5
AC RON	53.7	93.3	50.3	122.1	32	7.0	105.9	23	4.9
OAC ARISS	53.2	86.7	46.9	113.9	28	8.5	128.1	26	3.7
FUNDULEA	45.3	80.0	36.4	88.2	8	1.8	27.7	2	5.1
MARILEE	55.8	83.3	46.3	112.4	27	3.3	50.4	6	4.6
FREEDOM	45.7	76.7	35.0	85.1	6	1.8	27.2	1	3.4
AC CARTIER	52.5	83.3	43.9	106.8	22	5.5	82.8	17	3.6
AC MORLEY	46.2	80.0	36.9	89.8	9	4.9	73.7	14	4.4
25W33	46.5	80.0	37.2	90.4	10	8.5	129.1	27	5.2
HANOVER	55.3	86.7	48.6	118.1	30	3.4	51.4	7	4.4
MENDON	53.3	76.7	40.9	99.5	19	3.8	57.5	8	4.8
RC98109	47.2	80.0	37.7	91.7	12	5.9	88.8	19	5.6
PATRIOT	48.3	80.0	38.7	94.0	14	3.8	57.9	9	4.2
2540	47.0	73.3	34.9	84.7	5	7.8	118.5	25	4.8
FWB 728	64.2	93.3	60.4	146.9	35	5.1	77.6	15	4.1
CM96097	47.0	90.0	43.3	105.3	21	7.3	110.0	24	4.8
SUPERIOR	58.0	86.7	50.6	122.9	33	10.8	163.8	32	4.3
25R26	59.2	80.0	47.7	115.9	29	4.1	62.5	12	4.9
25W60	44.0	80.0	35.2	85.6	7	9.5	144.2	31	5.4
AC MACKINNON	48.8	80.0	39.1	95.0	16	6.6	99.9	20	4.8
AC MOUNTAIN	46.2	80.0	37.9	92.0	13	4.2	64.0	13	4.5
AC ESSEX	47.0	83.3	39.0	94.7	15	5.5	83.2	18	4.7
AC DELTA	55.3	90.0	50.1	121.8	31	20.7	312.7	35	2.1
ASHLAND	52.5	76.7	40.3	97.8	18	2.4	36.8	4	4.6
CM95009	46.3	80.0	37.3	90.6	11	4.0	60.1	11	5.1
CM951067	38.3	70.0	27.9	67.9	2	2.3	34.8	3	5.1
CALEDONIA	54.0	83.3	45.1	109.6	25	8.8	133.1	29	5.5
139J	59.2	76.7	45.6	110.7	26	3.2	48.0	5	5.3
TW95412	49.2	80.0	39.3	95.6	17	5.3	80.2	16	5.0
CM97001	40.5	76.7	31.3	76.1	3	9.1	137.7	30	3.1
CM546	51.3	83.3	43.2	104.9	20	4.0	60.1	10	5.0
TW96273	55.2	80.0	44.1	107.3	23	8.6	130.6	28	4.0
TW96/155	52.5	83.3	44.9	109.2	24	18.2	275.8	34	2.6
AC ZORRO	21.0	43.3	16.3	39.6	1	11.8	179.0	33	3.0
Mean	49.7	80.9	41.1	100.0		6.6	100.0		4.5
CV	22.8	11.7	28.9			36.9			15.5

2000 PMR REPORT # 126 **SECTION N: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**

CROP: Winter wheat (*Triticum aestivum* L.), cv. several
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: SUSCEPTIBILITY OF WINTER WHEAT VARIETIES TO FUSARIUM HEAD BLIGHT, AND CONTROL BY TEBUCONAZOLE (FOLICUR 432 F) IN ARTIFICIALLY INOCULATED, MISTED PLOTS. II.

MATERIALS: FOLICUR 432 F (432 g a.i./L tebuconazole)

METHODS: The crop was planted on October 20, 1999 at Ridgetown, Ontario using a 6-row cone seeder at 400 seeds/m^2. Plots were six rows wide, planted at a row spacing of 17.8 cm and 4 m in length placed in a randomized block design with four replications. The plots were fertilized and maintained using provincial recommendations. Front half of each plot (2 m in length) was sprayed with FOLICUR 432 F (432 g a.i./L) when primary wheat heads were at 50% anthesis for each variety (Zadoks growth stage 60 to 69,) using a back pack precision sprayer with a 1-m boom fitted with 2 twin jet nozzles spaced at 50 cm delivering 240 L/ha of water. Each plot was inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml two days following treatment with fungicide. The suspension was produced in liquid shake culture using modified Bilay's medium. Plots were misted daily beginning after the first plots were inoculated. The mist system was engaged until three days after the last variety was inoculated. Each variety was assessed for visual symptoms when the early dough stage was reached. Primary wheat heads were selected at random out of each plot, and rated for disease incidence and severity using the scoring system developed by Stack and McMullen. Disease levels were calculated as fusarium head blight index (FHBI), which was the product of the percent heads infected and the percent spikelets infected /100. The plots were harvested on July 18, 2000 and the yields were corrected to 14 % moisture. Deoxynivalenol (DON) content was estimated with three replications using a quantitative ELISA test.

RESULTS: The results are given below.

CONCLUSIONS: Mean FHB indices (41.1 versus 46.5) and DON content (8.5 versus 11.8 ppm) across cultivars were significantly (paired t-test P<0.01) lower, and yield was significantly (paired t-test P<0.01) higher (5.1 versus 4.2 T/ha) when FOLICUR applications were made. CM 98036 had the lowest DON level, while CM 24 had the lowest FHB index with/without FOLICUR. Pioneer 2540 had the highest DON content with/without FOLICUR, while CM 98091 had the highest FHB index with FOLICUR, and CM 98093 without FOLICUR.

Table 1. Fusarium head blight reaction, DON content (ppm by ELISA), and yield (T/ha) of winter wheat cultivars, with/without FOLICUR application, in artificially inoculated and misted plots at Ridgetown, Ontario, 2000.

	FOLICUR					NO FOLICUR				
Cultivars	Severity %	Incid -ence %	FHBI 0-100	Yield T/ha	DON ppm	Severity %	Incid -ence %	FHBI 0-100	Yield T/ha	DON ppm
HARUS	55.3	96.7	54.0	5.3	6.9	62.5	86.7	55.3	4.1	10.4
FREEDOM	45.7	76.7	35.0	3.4	1.8	51.7	80.0	41.3	4.1	2.1
CM 98036	45.5	76.7	34.8	6.3	1.9	55.3	83.3	45.8	4.5	4.9
CM 98091	81.3	100.0	81.3	6.1	8.0	65.0	100.0	65.0	4.5	15.6
CM 98093	63.3	100.0	63.3	5.8	12.8	78.3	100.0	78.3	4.2	14.5
CM 753	46.5	83.3	38.8	5.2	5.1	40.0	80.0	32.0	4.6	9.2
CM 951078	46.3	80.0	37.1	5.0	6.4	52.7	80.0	42.1	3.9	12.6
CM 98009	50.3	80.0	40.3	4.9	4.4	52.8	83.3	44.2	2.9	6.2
CM 98045	49.5	80.0	39.6	5.7	10.0	58.5	83.3	48.8	4.5	11.5
CM 98101	58.7	83.3	48.6	5.4	14.7	50.3	80.0	40.3	3.4	16.4
CM99058	35.8	73.3	26.3	5.4	6.9	37.5	76.7	28.8	4.4	8.5
CM 921	55.3	80.0	44.4	5.4	2.4	63.8	83.3	53.3	4.7	5.9
CM 922	60.8	83.3	52.4	4.1	9.8	52.5	76.7	40.3	3.7	13.4
CM 687	54.5	80.0	43.6	5.7	8.5	63.3	86.7	55.0	4.6	10.6
CM 24	30.0	66.7	20.2	5.7	3.8	35.8	70.0	25.3	5.8	6.7
CM 497	52.8	80.0	42.2	5.0	7.6	66.7	86.7	55.8	4.8	10.8
OAC97W:22S	48.7	83.3	41.2	5.0	11.8	57.2	86.7	49.8	3.9	13.5
OAC97W:40P	47.0	80.0	37.6	5.3	9.5	55.5	80.0	44.4	4.7	11.2
OAC95R:42S	44.7	80.0	35.7	4.5	5.8	51.7	80.0	41.3	3.2	9.8
OAC96R:9P	51.8	76.7	39.8	4.0	10.0	57.8	76.7	44.2	2.9	12.7
OAC97R:13P	41.7	80.0	33.3	4.7	8.1	49.7	80.0	39.7	3.8	11.3
OAC97R:32P	46.2	76.7	35.4	4.7	13.5	56.7	83.3	47.4	3.6	18.4
F9902	49.5	80.0	39.7	4.9	8.0	55.8	83.3	46.7	3.8	9.3
F9901	64.2	100.0	64.2	4.4	7.9	76.7	100.0	76.7	3.8	10.0
F9187	50.3	76.7	38.5	5.5	13.4	55.0	76.7	42.3	4.3	14.2
F9619	43.0	80.0	34.4	4.7	10.1	52.0	83.3	43.3	4.2	18.1
WBKO290B1	49.5	80.0	39.6	5.4	9.4	54.0	80.0	43.2	4.8	12.4
Pioneer 2540	49.8	76.7	38.0	4.7	17.2	56.2	80.0	44.9	4.1	22.6
WBLO274C1	51.2	73.3	37.6	5.2	6.2	56.2	80.0	45.2	4.1	11.2
WBLO476D1	51.2	83.3	42.8	5.5	8.5	50.3	83.3	42.2	4.3	9.9
CM98053	45.0	73.3	32.7	4.5	4.3	59.2	83.3	48.8	4.4	9.3
CM 97002	43.2	76.7	33.2	4.2	8.6	52.0	80.0	41.6	3.2	11.6
CM 97030	45.3	80.0	37.6	4.5	9.3	57.5	80.0	46.0	3.7	10.0
Mean	50.1	80.8	41.1	5.1	8.5	55.7	82.8	46.5	4.2	11.8
CV	12.7	6.8	14.9	12.2	37.5	10.3	6.4	13.4	15	28.7

CROP: Winter wheat (*Triticum aestivum* L.), cv. Pioneer 25W60 and Harus
PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: CONTROL OF FUSARIUM HEAD BLIGHT IN WINTER WHEAT WITH FUNGICIDES IN ARTIFICIALLY INOCULATED, MISTED PLOTS

MATERIALS: FOLICUR 432 F (432 g a.i./L tebuconazole), TILT 250 EC (250 g a.i./L propiconazole), AGRAL 90 (0.25 %).

METHODS: Two varieties of winter wheat (Pioneer 25W60 and Harus) were planted on October 20, 1999 at Ridgetown using a 6-row cone seeder at 400 seeds/m^2. Plots were six rows wide, planted at a row spacing of 17.8 cm and 4.0 m in length, in a randomized complete block design with four replications. Spray applications were made when primary wheat heads were at 50 % anthesis for each variety (Zadoks growth stage 60 to 69) using a back pack precision sprayer with a 1-m boom fitted with 2 twin jet nozzles spaced at 50 cm operated at 240 kPa delivering 240 L/ha. Each plot was inoculated with a 100-ml suspension of macroconidia of *F. graminearum* at 500,000 spores/ml two days following first treatment of fungicide. The suspension was produced in liquid shake culture using modified Bilay's medium. Plots were misted daily beginning after the first plots were inoculated. The mist system was engaged until three days after inoculation. Each variety was assessed for visual symptoms when the early dough stage was reached. Ten heads were selected at random out of each plot, and rated for disease incidence and severity using the scoring system developed by Stack and McMullen. Disease levels were calculated as fusarium head blight index (FHBI), which was the product of the percent heads infected and the percent spikelets infected /100.The plots were harvested on July 18, 2000 and the yields were corrected to 14 % moisture. Deoxynivalenol (DON) content was estimated in the three replications with the highest average FHBI using a quantitative ELISA test.

RESULTS: Results are given in the tables below.

CONCLUSIONS: There was no significant differences between the fungicides sprayed and control for DON level, or yield (T/ha). However, visual symptoms were significantly lower in treated compared with control plots after fungicide application.

Table 1. Fusarium head blight control in winter wheat (Pioneer 25W60) with foliar application of fungicides. Ridgetown, Ontario. 2000.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index (0-100)	Yield T/ha	DON (ppm)
FOLICUR 432 F + AGRAL 90	289 ml/ha	16.3	65.0	10.8	4.7	7.8
FOLICUR 432 F + AGRAL 90	434 ml/ha	11.3	61.3	6.8	5.4	8.0
TILT 250 EC	500 ml/ha	12.0	58.8	7.1	3.8	8.3
Control		21.5	80.0	17.2	4.3	10.6
Mean		15.3	66.3	10.5	4.6	8.7
LSD(P=.05)		5.0	12.5	5.0	NS	NS
CV		20.9	12.3	29.7	23.3	29.2

Table 2. Fusarium head blight control in winter wheat (Harus) with foliar application of fungicides. Ridgetown, Ontario. 2000.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index (0-100)	Yield T/ha	DON (ppm)
FOLICUR 432 F + AGRAL 90	289 ml/ha	17.3	61.3	11.0	5.8	4.7
FOLICUR 432 F + AGRAL 90	434 ml/ha	12.5	61.3	7.6	5.5	5.2
TILT 250 EC	500 ml/ha	12.5	66.3	8.3	5.6	5.2
Control		24.0	85.0	20.4	5.3	7.0
Mean		16.6	68.5	11.8	5.6	5.5
LSD(P=.05)		4.7	16.8	5.5	NS	NS
CV		18.3	16.4	30.1	5.2	28.7

2000 PMR REPORT # 128 **SECTION N: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**

CROP: Winter wheat (*Triticum aestivum* L.), cv. AC Ron
PEST: Fusarium seedling blight, *Fusarium graminearum* Schwabe

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TITLE: SEED TREATMENTS TO CONTROL FUSARIUM SEEDLING BLIGHT IN WINTER WHEAT

MATERIALS: U2584-01(RAXIL, tebuconazole 1.5 g a.i./L), LS251 ((tebuconazole 1.5 g a.i./L + metalaxyl 2.0 g a.i./L), LS075 (tebuconazole 1.5 g a.i./L + thiram 50 g a.i./L), U2055-11(carbathiin 56 g a.i./L + thiram 49 g a.i./L), U2568 (triadimenol 15 g a.i./L), DIVIDEND XL (difeconazole 38.3 g a.i./L + metalaxyl 3.19 g a.i./L).

METHODS: Seed was obtained from non-treated infected plots from the previous season. Fusarium damaged kernels were not removed. Seed was treated on 20 October, 1999 in individual plastic bags and rolled until throughly covered, in 750 g lots. The crop was planted on 24 October, 1999 at Ridgetown, and on 22 October, 1999 at Huron Research Station, Ontario using a 6-row cone seeder at 400 seeds/m2. Plots were six rows planted at a row spacing of 17.8 cm and 4 m in length, in a randomized complete block design with four replications. The whole, yellow-dent corn kernels were autoclaved and inoculated with two weeks old *Fusarium graminearum* culture (DAOM 178148). The kernels were colonized within two weeks. Each plot was inoculated in-furrow with *Gibberella zeae* produced on sterile corn kernels, at planting. The plots were fertilized and maintained according to Ontario provincial recommendations. The number of emerged plants in 1 m each of 2 rows was determined on 17 November, 1999 at Ridgetown, and 18 November, 1999 at Huron Research Station. Survival notes were taken on 4 April, 2000 at Huron Research Station, and 28 March 2000 at Ridgetown, in the same 1 m strip (2 rows) as with emergence data. Plots at Huron Research Station were trimmed back to 3.0 m before harvest. Yields were taken on 18 July, 2000 at both locations and corrected to 14% moisture. After harvest, sixty seeds from each treatment were surface sterilized in 3 % sodium hypochlorite solution for 3 min, air dried and placed on acidified potato dextrose agar (PDA). These were incubated for a seven days under ultraviolet light on a 12-h light, and 12-h dark cycle, at room temperature. *Fusarium* spp. were then transferred to carnation-leaf agar (CLA), and incubated as above. The identification was done according to Nelson et al. (1983), and Burgess et al. (1988).

RESULTS: Results are presented in the Tables below.

CONCLUSIONS: None of the treatments resulted in significant increases in emergence or yield. Neither was the number of tillers in the spring significantly different between the treatments and control at either location. U2584-01, U2055-11, and LS251 + LS176 significantly reduced percent of seed infected with *Fusarium graminearum* at Ridgetown.

Table 1. Emergence, survival, and yield of winter wheat treated with fungicides for the control of Fusarium seedling blight, Ridgetown and Huron Research Station, Ontario, 2000.

Seed Treatment	mLproduct/ kg seed	Emergence (Plants/1 m)		Survival (Tillers/1m)		Yield T/ha	
		Ridgetown	Huron	Ridgetown	Huron	Ridgetown	Huron
Control		70.3	71.3	58.3	61.5	5.3	5.3
U2584-01	1.80	46.8	77.6	46.6	62.8	4.9	5.2
LS251	3.30	65.5	74.1	56.4	61.6	5.0	6.1
LS075	2.50	65.4	64.0	57.5	59.0	5.1	6.1
U2055-11	3.30	60.4	66.0	50.0	61.1	5.2	5.1
U2568	2.40	63.8	63.6	49.0	56.1	4.5	5.3
LS251 + LS176	3.25 + 2.50	53.2	73.3	46.5	58.3	4.6	5.2
DIVIDEND XL	3.25	77.8	51.9	58.8	51.3	5.1	4.7
Mean		62.9	67.7	52.9	58.9	4.9	5.4
LSD (P=.05)		NS	NS	NS	NS	NS	NS

Table 2. Percent of seed infected with *Fusarium* spp., and *Fusarium graminearum*. Ridgetown, and Huron Research Station, Ontario, 2000.

Seed Treatment	(mL product) / kg seed)	*Fusarium* spp.[1]		*Fusarium graminearum*	
		Ridgetown	Huron	Ridgetown	Huron
Control		5.19	7.77	5.04	7.77
U2584-01	1.80	6.26	5.00	1.37	5.00
LS251	3.30	3.87	5.57	3.16	5.00
LS075	2.50	4.03	10.00	3.60	9.43
U2055-11	3.30	5.69	5.53	1.93	5.53
U2568	2.40	4.02	6.13	3.03	6.13
LS251 + LS176	3.25 + 2.50	3.49	12.20	1.93	11.10
DIVIDEND XL	3.25	3.46	5.00	3.46	5.00
Mean		4.50	7.15	2.94	6.87
LSD (P=.05)		NS	NS	2.98	NS

[1] *Fusarium graminearum* included.

2000 PMR REPORT # 129 **SECTION N: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**

CROP: Winter wheat (*Triticum aestivum* L.), cv. Unknown
PEST: Loose smut, *Ustilago tritici* (Pers.) Rostr.

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TITLE: SEED TREATMENTS TO CONTROL LOOSE SMUT IN WINTER WHEAT

MATERIALS: U2584-01 (RAXIL, tebuconazole 1.5 g a.i./L), LS251 (tebuconazole 1.5 g a.i./L + metalaxyl 2.0 g a.i./L), LS075 (tebuconazole 1.5 g a.i./L + thiram 50 g a.i./L), U2055-11(carbathiin 56 g a.i./L + thiram 49 g a.i./L), U2568 (triadimenol 15 g a.i./L), DIVIDEND XL (difeconazole 38.3 g a.i./L + metalaxyl 3.19 g a.i./L)

METHODS: Seed was obtained from non-treated, loose smut-infected plots from the previous season. Seed was treated on 20 October, 1999 in individual plastic bags and rolled until throughly covered, in 750 g lots. The crop was planted on 24 October, 1999 at Ridgetown, and on 22 October, 1999 at Huron Research Station, Ontario using a 6-row cone seeder at 400 seeds/m2. Plots were six rows planted at a row spacing of 17.8 cm, and 4 m in length placed in a randomized complete block design with four replications. The plots were fertilized and maintained according to Ontario provincial recommendations. The number of emerged plants in 1 m of each of 2 rows, was determined on 17 November, 1999 at Ridgetown, and 18 November, 1999 at Huron Research Station. Survival notes were taken on 4 April, 2000 at Huron Research Station, and 28 March 2000 at Ridgetown on the same 1-m strip (2 rows). Loose smut was evaluated at heading, on 12 July, 2000 at Ridgetown, and on 15 July, 2000 at Huron Research Station. The number of heads was estimated per plot by counting all the heads in 1m of row and then multiplying by the total row length of the plot. Total infected heads were counted per plot and these were expressed as a percentage of the total heads/plot. Yields were taken on 18 July, 2000 and corrected to 14% moisture.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: All the material tested provided excellent control of loose smut. The treatments LS 251 and LS 075 significantly increased yield at Ridgetown. There was no significant effect on emergence or survival.

Table 1. Emergence, survival, percent heads infected, and yield of winter wheat treated with fungicides for the control of loose smut, Ridgetown and Huron Research Station, Ontario, 2000.

Seed Treatment	mL product /kg seed	Emergence (plants/1m)		Survival (Tillers/1m)		Percent heads infected L. Smut		Yield (Tonne/ha)	
		Ridgetown	Huron	Ridgetown	Huron	Ridgetown	Huron	Ridgetown	Huron
Control		87.1	96.3	52.9	65.4	20.00	5.80	3.9 b[1]	3.0
U2584-01	1.80	85.5	94.9	49.9	65.6	0.00	0.00	4.2 b	3.0
LS251	3.30	89.5	98.9	50.0	65.9	0.00	0.00	5.2 a	3.6
LS075	2.50	87.8	93.8	56.0	64.3	0.00	0.00	5.5 a	3.6
U2055-11	3.30	96.6	96.3	52.3	68.6	0.25	0.50	4.0 b	2.9
U2568	2.40	102.0	89.9	55.0	65.8	0.00	0.50	4.3 b	3.1
LS251 + LS176	3.25 + 2.50	91.5	96.9	48.3	65.5	0.00	1.00	4.2 b	3.1
	3.25	89.8	96.1	55.4	67.3	0.00.	0.80	3.9 b	3.2
Mean		91.2	95.4	52.5	66.0	2.50	1.10	4.4	3.3
LSD (P=.05)		NS	NS	NS	NS	1.50	2.10	0.9	NS

[1] Numbers within a column followed by the same letter are not significantly different at $P \leq 0.05$.

END OF SECTION N
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SECTION O:	**ORNAMENTALS, GREENHOUSE and TURF DISEASES /Les maladies de plantes ornementales, de serre et de gazon**
REPORT /RAPPORT #:	**130**
PAGES:	**327 - 328**
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2000 PMR REPORT # 130 **SECTION O: ORNAMENTALS, GREENHOUSE and TURF - Diseases**
STUDY DATABASE: 87000180

CROP: Choke cherry, *Prunus virginiana* var. *melanocarpa* (A. Nels.) Sarg.
PEST: Choke cherry leaf spot, *Coccomyces lutescens* Higgins

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TITLE: EVALUATION OF PRODUCTS FOR PREVENTION OF CHOKE CHERRY LEAF SPOT ON CHOKE CHERRY SEEDLINGS IN SASKATCHEWAN, IN 2000

MATERIALS: BENLATE (benomyl 50%), BRAVO (chlorothalonil 50%), FUNGINEX (triforine 19%)

METHODS: Choke cherry leaf spot is a disease of seedling choke cherry. This disease can cause complete defoliation of seedlings by mid-June, which results in reduced annual growth or even the death of seedlings. Currently, BENLATE is the only product registered for control of this disease on choke cherry. This trial was conducted to evaluate alternate products for the prevention of the disease and to reduce the potential of developing benomyl resistant strains of the fungus.

Treatments included benomyl at a rate of 1.1 kg ai/ha, chlorothalonil at 3.75 kg ai/ha, triforine at 0.475 kg ai/ha and a water applied check. The four treatments were replicated five times in a randomized complete block design. The trial was conducted on first-year choke cherry seedlings located at the PFRA Shelterbelt Centre (NW 11-18-13-W2) near Indian Head, Saskatchewan. The trial was set up on eight rows of choke cherry seedlings. Rows were spaced 80 cm apart, with seedlings spaced an average of 1.4 cm apart within the row. Treatment plots were 10 metres in length with a two metre buffer between plots.

Treatments were applied five times during the growing season, (5, 25 May, 28 June, 17 July and 9

August). Treatments were applied with a horizontal boom delivering 565 L/ha through 8004 nozzles operating at 290 kPa. A visual assessment of choke cherry leaf spot was conducted (15 August) using the following rating system: 0 - no leaf spot present; 1 - few leaf spots noted; 2 - numerous leaf spots apparent and some leaf curling; 3 - excessive leaf curling and some defoliation; 4 - severe defoliation. To determine the effect fungicide treatments had on choke cherry seedlings, four 30 cm samples were randomly selected from each treatment plot between 21 and 23 August. The number of seedlings, the height of each seedling and weight of each seedling was recorded from each 30 cm sample. Analysis of variance (ANOVA) was conducted using General Linear Model with the means separated by the Duncan's Multiple Range Test.

RESULTS: The visual assessment rating of choke cherry leaf spot indicated that BENLATE and BRAVO treatments had less disease symptoms compared to the FUNGINEX and water check treatments (Table 1). Seedling survival was not significantly affected by fungicide treatment, as indicated by the number of seedlings per metre. Seedlings produced in the BENLATE and BRAVO treated plots were significantly taller and heavier than seedlings produced in the water check. Seedlings produced in the BENLATE treated plots were significantly taller and heavier than seedlings produced in the BRAVO treatment. There was no significant difference in seedling height and weight between seedlings produced in the FUNGINEX and water check treated plots.

CONCLUSIONS: BENLATE was the most effective fungicide in preventing choke cherry leaf spot on first-year choke cherry seedlings. BRAVO could be used as an alternative fungicide to reduce the potential development of benomyl resistant strains of choke cherry leaf spot. Additional fungicide trials should be conducted to determine if there is a product that is as effective as BENLATE in preventing choke cherry leaf spot and to determine the effectiveness of conducting alternate applications of BENLATE and BRAVO. FUNGINEX should not be evaluated in future trials.

Table 1. Evaluation of products for prevention of choke cherry leaf spot on choke cherry seedlings at Indian Head, Saskatchewan in 2000.

Treatment	Rate per ha	Leaf spot rating	Number seedlings / m	Seedling height (cm)	Seedling weight (g)
BENLATE	2.2 kg	2	63.51 a[1]	11.78 c	2.69 c
BRAVO	7.5 L	2	73.26 a	8.85 b	1.57 b
FUNGINEX	2.5 L	3	69.3 a	7.92 ab	0.3 a
Water check	-	4	72.93 a	6.24 a	0.17 a

[1] Means in the same column followed by the same letter are not significantly different at the 5% level according to the Duncan's Multiple Range Test.

END OF SECTION O
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SECTION P: **NEMATODES/ Nématodes**
REPORT /RAPPORT #: **131 - 133**
PAGES: **329 - 336**
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2000 PMR REPORT # 131 **SECTION P: NEMATODES**
ICAR: 206003

CROP: Carrot (*Daucus carota*), cv. Cellobunch
PEST: Lesion Nematode (*Pratylenchus penetrans*)
Pythium Root Die Back (*Pythium* spp.)

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TITLE: EVALUATION OF TELONE C-17 FOR THE CONTROL OF NEMATODES AND PYTHIUM ROOT DIE BACK, 2000

MATERIALS: TELONE C-17 (dichloropropene and chloropicrin)

METHODS: The trial was established on a commercial farm in Bradford, Ontario. Severe stunting caused by pythium root die back was noted in the fields in previous years during commercial production. Carrots were seeded on hills (86 cm apart) in organic peat soil (50% organic matter, pH 6.0) on 30 May 2000 using a tractor-mounted seeder. Treatments were four hills wide, 10 meters in length with six replications per treatment. Each treatment was applied under the center of each hill at a depth of 20 cm, using a John-Blue fumigator shank. TELONE C-17 was applied at a rate of 57 L/ha of product. A check was included adjacent to each of the fumigated areas. Soil samples were taken on 11 July to determine if nematode populations were present in the field. Samples of 2.33 meters of row were harvested on 30 October. Carrots were graded for marketability, nematode damage and Pythium. The 0-5 scale rating from Beliar and Boivin 1988 was used to assess pythium damage. The air temperatures were above the long term (10 year) average for May (13.6 °C), below average for June (17.5 °C), July (18.7 °C) and August (18.7 °C) and average for September (14.5 °C). Total rainfall was above the long term (10 year) average for May (160.3 mm), June (173.4 mm), and August (75.7 mm), below average for September (79.8 mm) and average for July (86.4). Data were analyzed using the Gosset Paired T Test of the One, Two and Multi-sample Tests of Statistix, V. 4.1.

RESULTS: As outlined in Table 1.

CONCLUSIONS: No significant differences were observed among the treatments. Heavy rainfall in late May and early June could be responsible for the high levels of pythium in the TELONE treatment. No phytotoxicity was observed in the initial stand or the final yield.

Table 1. Comparison of TELONE C-17 at 34 L/ha and 57 L/ha for the control of root knot and lesion nematodes and Pythium root die back, 2000.

Treatment	% Marketable	% Lesion nematode	Lesion Rating	% Pythium root die back	Pythium Rating
TELONE C-17 CHECK	73.1	4.41	3	19.5	3.3
TELONE C-17 @ 34 L/ha	73.8	6.95	3.3	18.1	3.3
P = 0.05	ns [1]	ns	ns	ns	ns

[1] No significant differences were observed among treatments (P = 0.05), Gosset Paired T Test.

2000 RAPPORT RLD # 132 **SECTION P: ÉTUDES DES NÉMATODES**
BASE DE DONNÉES DES ÉTUDES: 335-1252-9803

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Nématode des lésions, *Pratylenchus penetrans*

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TITRE: ROTATION DES CULTURES POUR LE CONTRÔLE DU NÉMATODES DES LÉSIONS DANS LA POMME DE TERRE

PRODUITS: VAPAM (métham sodium)

MÉTHODES: L'essai a été réalisé à Val-Barrette (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Chaque parcelle mesurent 6.1 m de large x 14 m de long. Le millet perlé fourrager (FMH2) (*Pennisetum glaucum* L.), hybrides de millet perlé grain (*Pennisetum glaucum* L.) (GMH6), le sorgho grain (*Sorghum bicolor* L.) (GS7) et l'hybride de), et l'avoine (*Avena sativa* L. cv. Capital), ont été semés en 1998. En 1999, quatre parcelles de pomme de terre, dans lesquelles l'avoine avait été semée comme culture témoin en 1998, ont été fumiguées en bande sur les rangs avec du Vapam (124 L/ha) à l'automne 1998. En 1999, les tubercules de pomme de terre ont été mis en terre durant la seconde semaine de juin, 28 cm entre les plants et 91 cm entre les rangs. Toutes les parcelles ont reçu 1681 kg/ha de fertilisant 10-12-12 et 84 kg/ha d'urée. Pour le contrôle des mauvaises herbes, l'herbicide Roundup a été appliqué le 20 septembre 1998 au taux de 2,47 L/ha et de l'herbicide Sencor a été utilisé (0,84 kg/ha) durant la saison de croissance. Le 31 août 1999, les rendements pour les tubercules de pomme de terre ont été déterminés en récoltant quatre fois 2 m de rang à l'intérieur de chacune des parcelles de façon aléatoire. Tous les tubercules de pomme de terre ont été pesées selon la classification suivante: classe-J > que 8,25 cm diam., classe-B < que 4,8 cm diam.; et classe-A entre 4.8 and 8.25 cm diam.. Le rendement total des tubercules a été exprimé en tonnes métriques par hectare. Les échantillons de sol et de racines ont été collectés à chacun des sites pour les deux expérimentations pour évaluer la densité des populations de nématodes des lésions. Pour le premier échantillonnage, 12 pelletées de sol (5 cm diam. x 20 cm profond) par parcelle ont été collectées aléatoirement sur les rangs et entre les rangs. Pour le deuxième et le troisième échantillonnage, le sol et les racines ont été collectés ensemble. Les racines et le sol ont été placés dans des sacs de plastique et ensuite déposés dans une chambre froide à 4°C jusqu'à l'extraction des nématodes. La densité des populations de nématodes a été estimée en utilisant la technique de l'assiette de Baermann à l'aide de deux sous-échantillons de 50 cm^3 pour chaque parcelle. Les racines ont été lavées et deux sous-échantillons par parcelle ont été placés dans une chambre à brouillard pendant deux semaines à 22°C (Seinhorst 1950). Après l'extraction des nématodes, les racines ont été séchées à 65°C durant deux jours et ensuite elles ont été pesées. Les nématodes ont été comptés à l'aide d'un binoculaire et le nombre de nématodes a été exprimé en nombre par kg de sol et nombre par g de racines sèches.

RÉSULTATS: Les rendements en tubercule de pomme de terre n'ont pas été significativement affectés par les cultures de rotation effectuées en 1998 (Tableau 1). De plus, la fumigation n'a pas augmenté les rendements de tubercules de pomme de terre en comparaison avec la rotation avec l'avoine non-fumiguée.

CONCLUSIONS: À Val-Barrette, les cultures de rotation cultivées en 1998 n'ont pas eu d'impact sur les populations de nématodes des lésions observées dans le sol au premier échantillonnage effectué en 1999. En 1998, toutes les parcelles étaient fortement infestées de mauvaises herbes, qui sont pour la plupart de très bons hôtes pour le nématode des lésions. La présence des mauvaises herbes dans toutes les parcelles peut annuler ou réduire les effets bénéfiques des cultures de rotation. Nous croyons que la présence des mauvaises herbes peut expliquer l'absence d'impact des cultures de rotation sur les populations de nématodes ainsi que sur les rendements des tubercules de pomme de terre observés en 1999. Il est également important de mentionner que les rendements de pomme de terre sur ce site étaient très faible dans leur ensemble notamment à cause de la sécheresse et de la faible fertilité du sol.

Tableau 1. Populations de *Pratylenchus penetrans* dans la culture de pomme de terre cultivée en 1999 Dans les parcelles où les cultures de rotation ont été cultivées en 1998 à Val-Barrette.[1]

Cultures de rotation (1998)	Nombres de nématodes des lésions[2]			
	Par kg de sol		Par g de racines sèches	
	3 août 1999	31 août 1999	3 août 1999	31 août 1999
GMH6	9690 aA	12000 aAa	4487 aA	4486 aA
FMH2	3727 bA	4970 bcA	2517 abA	704 aB
GS7	6747 bA	9535 abA	4567 aA	1428 abB
Avoine[3]	7873 abA	4245 cB	3461 abA	1228 aA
Avoine fumiguée[4]	4580 bA	1490 dB	1426 bA	847 bB

[1] Les données sont des moyennes arithmétiques de quatre réplicats.

[2] Les valeurs logarithmiques dans la même colonne suivies de la même lettre minuscule et dans la même ligne suivies de la même lettre majuscule ne sont pas différentes significativement ($P \leq 0.05$) l'une de l'autre, comme déterminé par le test de Waller.

[3] Avoine cv. Capital.

[4] Avoine fumiguée veut dire que le traitement à la fumigation a été fait en 1999, avant de planter les tubercules de pomme de terre, dans les parcelles où l'avoine a été utilisée comme culture de rotation en 1998.

Tableau 2. Rendements des tubercules de pomme de terre en 1999 dans les parcelles où les cultures de rotation ont été cultivées en 1998 à Val-Barrette.[1]

Cultures de rotation (1998)	Rendements des tubercules de p. de terre (tonne/ha)[2]			
	Classe-A	Classe-J	Classe-B	Total
GMH6	8.31 a	2.24 a	0.76 a	11.31 a
FMH2	8.87 a	1.40 a	1.20 a	11.47 a
GS7	7.26 a	1.45 a	0.92 a	9.63 a
Avoine[3]	8.25 a	3.20 a	1.06 a	12.51 a
Avoine fumiguée[4]	7.88 a	2.85 a	0.65 a	11.38 a

[1] Les données sont des moyennes arithmétiques de quatre réplicats.

[2] Les valeurs logarithmiques dans la même colonne suivies de la même lettre minuscule ne sont pas significativement différentes (P 0.05) l'une de l'autre, comme déterminé par le test de Waller.

[3] Avoine cv. Capital.

[4] Avoine fumiguée veut dire que le traitement à la fumigation a été fait en 1999, avant de planter les tubercules de pomme de terre, dans les parcelles où l'avoine a été utilisée comme culture de rotation en 1998.

2000 PMR REPORT # 133 **SECTION P: NEMATODES**
ICAR: 206003

CROP: Wheat (*Triticum aestivum*), cvs. AC Barrie, AC Walton, AC Wilmot, Belvedere, Glenlea
PEST: Lesion Nematode, *Pratylenchus penetrans*

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TITLE: CONTROL OF NEMATODES IN WHEAT

MATERIALS: TEMIK (aldicarb 15 G) and fosthiazate (900g/L EC)

METHODS: The trial was conducted in 1999 at the AAFC Research Farm at Harrington, Prince Edward Island. The site had a fine sandy loam with a pH of 5.8-6.0, the previous crop was soybean (*Glycine max* L. cv. Maple Amber), and cereals had not been planted in the past four years. The individual plot sizes were 6.5 m by 1.8 m, the experimental design was a randomized complete bock with four replicates, and the treatments were: 1) untreated check, 2) TEMIK granular broadcast by hand at 2.24 kg a.i./ha, and 3) fosthiazate emulsifiable concentrate applied with a back sprayer at 13.5 kg a.i./ha. The chemicals were applied on May 28, and all plots were worked to a depth of 10 cm with a rototiller. On the same date after the chemicals were applied, seeding took place at a rate of 350 seeds per m^2, at a depth of 2 cm and with row spacings of 17.8 cm. NPK fertilizer (17-17-17) was then broadcast at 250 kg/ha. On June 8, ammonium nitrate at 100 kg/has was broadcast. Refine Extra at 20 g/ha, and 2,4-D at 1 L/ha with Agrol 90 surfactant at 0.2 L/ha were applied on June 27. Samples for nematode analyses were taken from root zone soil on May 27, and from root zone soil and roots on August 29. Harvest was on September 1.

RESULTS: As outlined in Tables 1 and 2.

CONCLUSIONS: The application of the chemicals, as expected, reduced the root lesion nematode populations significantly in soil and roots and fosthiazate was more effective than TEMIK ($P \leq 0.001$). There was a cultivar effect for nematodes in soil ($P \leq 0.004$), but there were no treatment x cultivar interactions (Table 1). The nematicide treatments increased grain yields by an average of 23.7 % ($P \leq 0.001$), and ranged from 15.1 % for AC Wilmot to 31.7 % for AC Walton (Table 2). This variation resulted in a cultivar effect ($P \leq 0.001$) and a cultivar x treatment interaction ($P \leq 0.002$) for yield.

Table 1. Effect of nematicides on the population density of root lesion nematodes[1] in root zone soils and roots of different spring wheat cultivars.

Cultivar	Untreated	TEMIK	Fosthiazate	Cultivar means
Per kg of oven dried soil[2]				
AC Barrie	69303	5700	2350	4530 a[4]
AC Walton	12940	4760	5320	6900 a
AC Wilmot	9460	3840	4430	5430 a
Belvedere	17180	5650	2590	6310 a
Gleanlea	5510	2700	1050	2490 b
Treatment means	9570 a4	4370 b	2730 c	
Per g of oven dried root[2]				
AC Barrie	3590	720	90	610 a[4]
AC Walton	3100	470	380	820 a
AC Wilmot	7280	1200	280	1350 a
Belvedere	8670	780	400	1400 a
Glenlea	2850	1600	150	870 a
Treatment means	4580 a[4]	870 b	220 c	

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[1] Primarily *Pratylenchus penetrans*.

[2] Samples collected on 29 August 1999. Grand mean (n=60) for samples taken on 27 May 1999 was 1790/kg of soil.

[3] Back-transformed mean.

[4] Cultivar means in the column or treatment means in the row followed by the same letter are not different ($P \leq 0.05$) according to Duncan's multiple range test.

Table 2. Effect of nematicide treatments on grain yields in different spring wheat cultivars.

Cultivar	Grain yields (kg/ha)				
	Untreated	ALDICARB	Fosthiazate	Cultivar means	% increase[1]
AC Barrie	2334	2825	2822	2660b[2]	21
AC Walton	2628	3260	3664	3184a	31.7
AC Wilmot	2839	3290	3245	3125a	15.1
Belvedere	2690	3406	3148	3081a	21.8
Glenlea	2305	3269	2706	2760b	29.6
Treatment means	2559a[2]	3210b	3117b		23.7

[1] Mean of grain yields in nematicide-treated plots vs. mean in untreated plots.

[2] Cultivar means in the column or treatment means in the row followed by the same letter are not different ($P \leq 0.05$) according to Duncan's multiple range test.

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SECTION Q: **CHEMICAL RESIDUES/Résidus**
REPORT /RAPPORT #: **134**
PAGES: **337-336**
EDITOR: **Dr. Brian D. Ripley**

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2000 PMR REPORT # 134 **SECTION Q: CHEMICAL RESIDUES**
STUDY DATA BASE: 387-2112-9701

CROP: N/A
PEST: N/A

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TITLE: DETECTION OF HERBICIDES IN ALBERTA RAINFALL IN 1999

MATERIALS: 2,4-D, 2,4-DB, bromoxynil, clopyralid, dicamba, dichlorprop, diclofop, fenoxaprop, MCPA, mecoprop, quinclorac, triallate, trifluralin.

METHODS: A 25-cm i.d. stainless steel funnel, setup 60 cm above ground over a 4 liter amber bottle, was used to sample rainfall at the following Alberta locations (duplicate funnels at each location): 1 remote southern Alberta location at Lundbreck, 2 City of Lethbridge residences, 9 southern Alberta rural locations at Fort Macleod, Lethbridge Research Centre (2 locations), Coaldale, Tempest, Grassy Lake, Seven Persons, Warner and Champion, and 4 central Alberta rural locations at Strathmore, Three Hills, Clive and Vegreville. Rainfall samples were collected at intervals of 3-14 d from April 15 to August 24, 1999. Some samples were intentionally collected during dry periods by rinsing the funnels to check for dry deposition. Samples were extracted by liquid-liquid partitioning into dichloromethane, methylated using diazomethane and analyzed for the following 13 herbicides using MSD-GC with ion-ratio confirmation: 2,4-D, 2,4-DB, bromoxynil, clopyralid, dicamba, dichlorprop, diclofop, fenoxaprop, MCPA, mecoprop, quinclorac, triallate, trifluralin.

RESULTS: Major detections are summarized in Table 1 with herbicide detections expressed on both a $\mu g/m^2$ and a ppb ($\mu g/L$) basis. The ppb values depend on the amount of rainfall, but relate to the Canadian Water Quality guidelines and to other reports. Herbicides were detected in the rainfall on most sample dates, at every location. Herbicide detections were lowest at the remote site (non-farming area), intermediate at the City of Lethbridge sites, and highest at the rural locations. In southern Alberta, 2,4-D was detected most frequently and in the highest amounts (max. 30 ppb, 70 μg/m^2), with bromoxynil and dicamba usually also present. In central Alberta, MCPA was detected in the highest amounts (max. 4.4 ppb, 57 μg/m^2), with 2,4-D, bromoxynil and dicamba detected most frequently. The dry sample collections (all at southern Alberta sites) yielded small amounts of 2,4-D (1-9 μg/m^2) and traces (<1 μg/m^2) of bromoxynil and dicamba. No dry samples were collected in central Alberta because of the frequency of rain events in that area. The other 9 herbicides were all detected sporadically in 1999 rainfall, but usually only in trace amounts (<10 μg/m^2).

CONCLUSION: The herbicide amounts detected in Alberta rainfall in 1999 seem unusually high, especially the maximum 2,4-D amounts, which were 60-100 times higher than the herbicides previously reported in rainfall at other Canadian (Manitoba, Ontario) locations. These herbicide detections raise the possibility of sub-lethal effects on sensitive plant species and negative impacts on surface water quality. Indoor bioassays and further rainfall sampling are planned for 2000.

Table 1. Major detections of herbicides in southern Alberta rainfall in 1999.

Site Type (no. sites)	Herbicide		No.Sample Collections	No. Detns	Average	Max
Remote (1)			14			
	2,4-D	µg/m^2		4	5.1	9.7
		ppb		4	0.6	1.7
	Bromoxynil	µg/m^2		4	2	3.4
		ppb		4	0.2	0.5
	Dicamba	µg/m^2		6	0.9	2
		ppb		6	0.1	0.2
	MCPA	µg/m^2		0	-	-
		ppb		0	-	-
City of Lethbridge (2)			36			
	2,4-D	µg/m^2		25	7.2	22
		ppb		24*	1.7	9.8
	Bromoxynil	µg/m^2		14	2.3	5.6
		ppb		14	0.6	1.7
	Dicamba	µg/m^2		21	1	2.6
		ppb		21	0.2	0.8
	MCPA	µg/m^2		2	10	11
		ppb		2	4.1	4.2
Rural Southern AB (9)			131			
	2,4-D	µg/m^2		89	15	70
		ppb		89	2.7	30
	Bromoxynil	µg/m^2		64	4.6	17
		ppb		59*	1.2	26
	Dicamba	µg/m^2		79	1.9	11
		ppb		77*	0.4	3.1
	MCPA	µg/m^2		16	13	47
		ppb		16	4.5	11
Rural Central AB (4)			63			
	2,4-D	µg/m^2		28	8.2	33
		ppb		28	0.6	2.7
	Bromoxynil	µg/m^2		27	4.8	28
		ppb		27	0.3	2.2
	Dicamba	µg/m^2		21	1.2	3
		ppb		21	0.2	1.2
	MCPA	µg/m^2		8	20	57
		ppb		8	1.9	4.4

[1] No. of ppb detections is less because some sample collections were dry samples; ppb not applicable.

END OF SECTION Q; REPORT # 134; PAGES 337-339; END OF PLANT PATHOLOGY (J-Q)

RM Business Use Case
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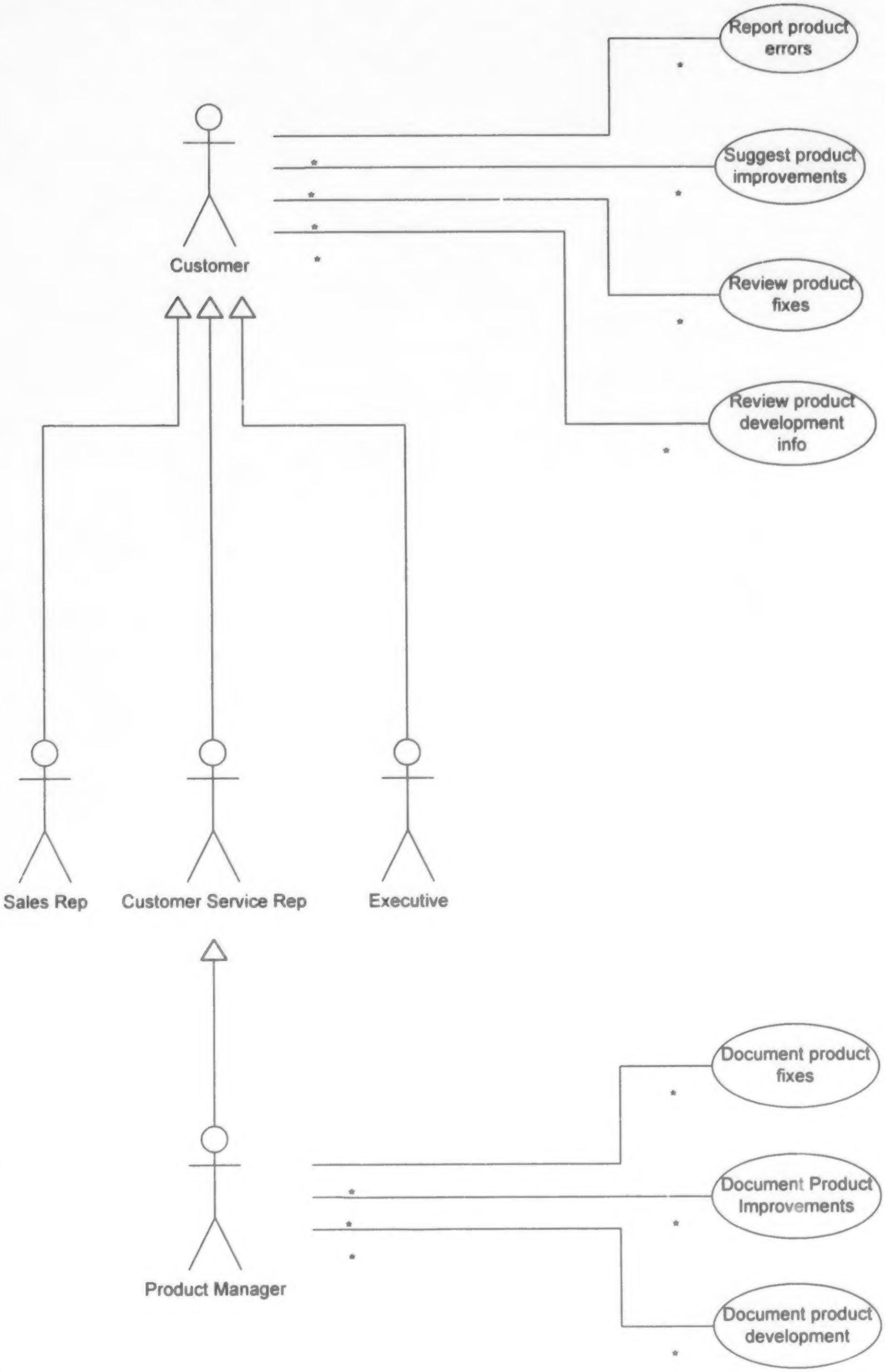
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